3500

SERIES

invensys
EUROTHERM

ENG **User Guide**

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3508 and 3504 Process Controllers

1. Chapter 1 Installation

1.1 What Instrument Do I Have?

Thank you for choosing this Controller.

The 3508 controller is supplied in the standard 1/8 DIN size (48 x 96mm front panel). The 3504 controller is supplied in the standard ¼ DIN size (96 x 96mm front panel). They are intended for permanent installation, for indoor use only, in an electrical panel which encloses the rear housing, terminals and wiring on the back.

3508 Controller

3504 Controller

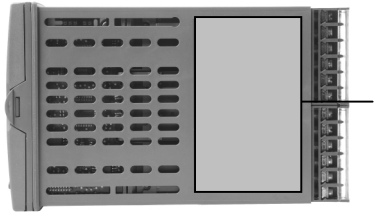
1.1.1 Contents of Package

When unpacking your controller please check that the following items have been included.

1.1.1.1 3508 or 3504 Controller Mounted in its Sleeve

The 3504 contains up to six plug-in hardware modules; the 3508 has up to three. Additionally digital communications modules can be fitted in two positions.

The modules provide an interface to a wide range of plant devices and those fitted are identified by an ordering code printed on a label fixed to the side of the instrument. Check this against the description of the code given in section 1.2 to ensure that you have the correct modules for your application. This code also defines the basic functionality of the instrument which may be:-



Label showing:- Instrument Order Code

- Controller only
- Programmer and controller
- Control type – Standard PID, valve positioner
- Digital communications type
- Options

1.1.1.2 Panel Retaining Clips

Two clips are required to secure the instrument sleeve in the panel. These are supplied fitted to the sleeve.

1.1.1.3 Accessories Pack

For each input a 2.49Ohm resistor is supplied for mA measurement. This will need to be fitted across the respective input terminals

1.1.1.4 This User Guide

Issue 2 of this guide applies to instrument software version V1.10 and explains:-

- How to install the controller
- Physical wiring to the plant devices
- First switch on - 'out of the box'.
- Principle of operation using the front panel buttons
- Introduction to configuration through iTools PC software

Whenever the symbol ☺ appears in this handbook it indicates a helpful hint

1.2 3504 and 3508 Ordering Code

Hardware Coding

Model Number	Function	Supply Voltage	Number of Loops	Application	Programs	Recipes	Toolkits	Colour

Model Number	
3504	3504 Standard
3508	3508 Standard

Loops	
X	Single Loop

Programs	
1	1 prog 20 segments
10	10 prog 50 segments
25	25 prog 100 segments
50	50 prog 200 segments

Toolkit Wires	
XX	Std 30 wires
60	60 wires
120	120 wires
250	250 wires

Function	
CC	Controller only
F	Profibus controller

Supply Voltage	
VH	85-254Vac
VL	20-29Vac/dc

Recipes	
1	1 recipe
4	4 recipes
8	8 recipes

Colour	
G	Eurotherm green
S	Silver

Application	
XX	Standard
ZC	Zirconia
VP	Dual Valve Position

1.2.1 Input and Output Modules

3504 only

IO Slot 1	IO Slot 2	IO Slot 3	IO Slot 4	IO Slot 5	IO Slot 6	Comms H	Comms J

Config Tools	Instrument Language	Manual Language	Extended Warranty	Cal Certificate	Custom Label	Non-standard

IO Slots 1-3 (3508); 1-6 (3504)	
XX	None fitted
R4	Change over relay
R2	2 pin relay
RR	Dual relay
T2	Triac
TT	Dual triac
D4	DC control
AM	Analogue input (not slot 2 or 5)
D6	DC retransmission
TL	Triple logic input
TK	Triple contact input
TP	Triple logic output
VU	Potentiometer input
MS	24Vdc transmitter PSU
G3	Transducer PSU 5 or 10Vdc
LO	Isolated single logic output

H Comms Slot	
XX	Not Fitted
A2	232 Modbus
Y2	2-wire 485 Modbus
F2	4-wire 485 Modbus
AE	232 EI-Bisynch
YE	2-wire 485 EI-Bisynch
FE	4-wire 485 EI-Bisynch
ET	Ethernet 10base
PB	Profibus
DN	Devicenet

J Comms Slot	
XX	Not Fitted
A2	232 Modbus
Y2	2-wire 485 Modbus
F2	4-wire 485 Modbus
EX	IO Expander

Config Tools	
XX	None
IT	Standard iTools

Instrument Language	
ENG	English
FRA	French
GER	German
SPA	Spanish

Manuals Language	
ENG	English
FRA	French
GER	German
SPA	Spanish
XXX	None

Extended Warranty	
WL005	Extended 5 year

Cal Certificate	
XXXXX	None
CAL1	Cert of conformity
CAL2	Factory cal cert
CAL3	Custom Cal Cert

Custom Labels	
F1234	Special No
XXXXX	None

Non-standard Option	
EU1234	Special No
EC1234	Custom curve
EE1234	Custom config
ES1234	Cust software

Example 3504/VH/1/XX/10/4/60/G/TT/XX/XX/XX/XX/XX/Y2/XX/IT/ENG/ENG/WL003

3504 CONTROLLER, 85-264Vac, 10 programs, 4 recipes, 60 wires, dual triac output, 2-wire RS485 comms, iTools, English manual

1.3 How to Install the Controller

This instrument is intended for permanent installation, for indoor use only, and to be enclosed in an electrical panel.

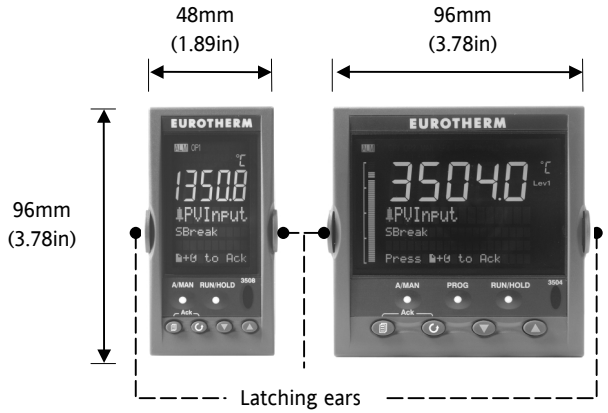
Select a location where minimum vibrations are present and the ambient temperature is within 0 and 50°C (32 and 122°F).

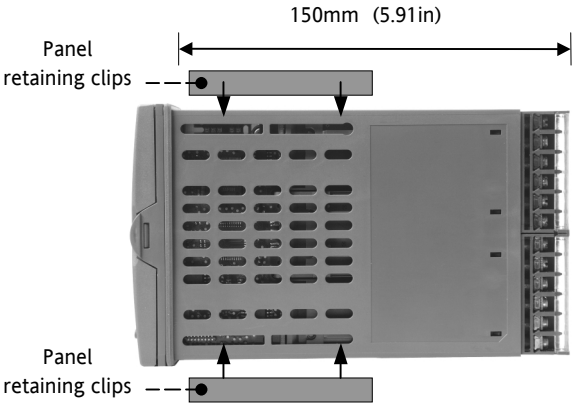
The instrument can be mounted on a panel up to 15mm thick.

To assure IP65 and NEMA 4 front protection, use a panel with smooth surface texture.

Please read the safety information, at the end of this guide, before proceeding and refer to the EMC Booklet part number HA025464 for further information.

1.3.1 Dimensions

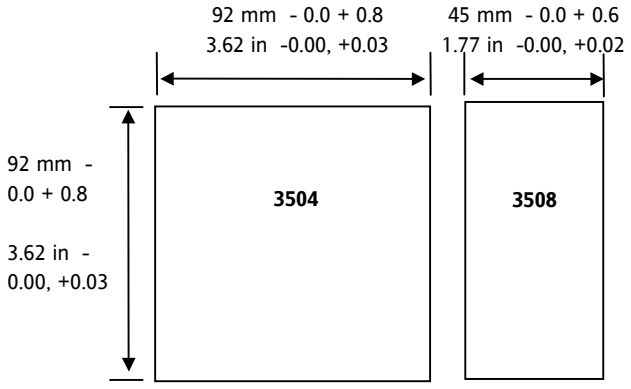




1.3.2 To Install the Controller

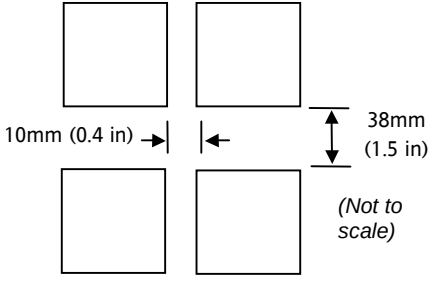
1.3.2.1 Panel Cut-out

1. Prepare the panel cut-out to the size shown in the diagram
2. Insert the controller through the cut-out.
3. Spring the panel retaining clips into place. Secure the controller in position by holding it level and pushing both retaining clips forward.
4. Peel off the protective cover from the display



1.3.2.2 Recommended Minimum Spacing

5. The recommended minimum spacing between controllers shown here should not be reduced to allow sufficient natural air flow

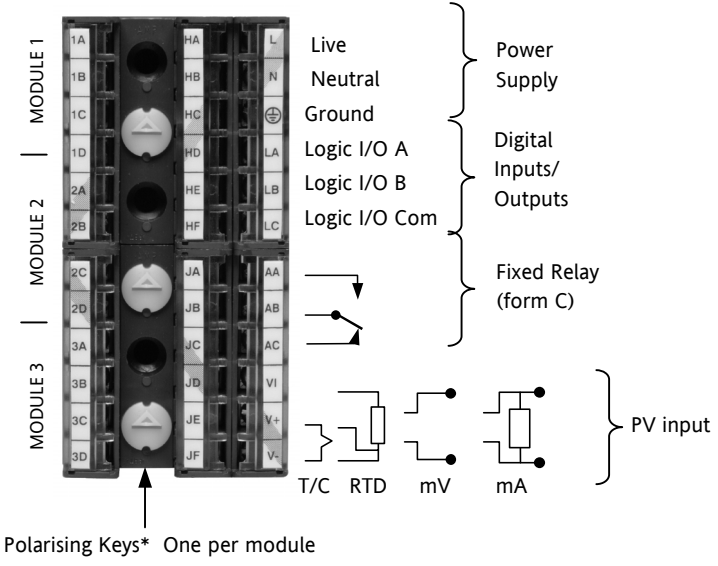


1.3.3 Unplugging the Controller

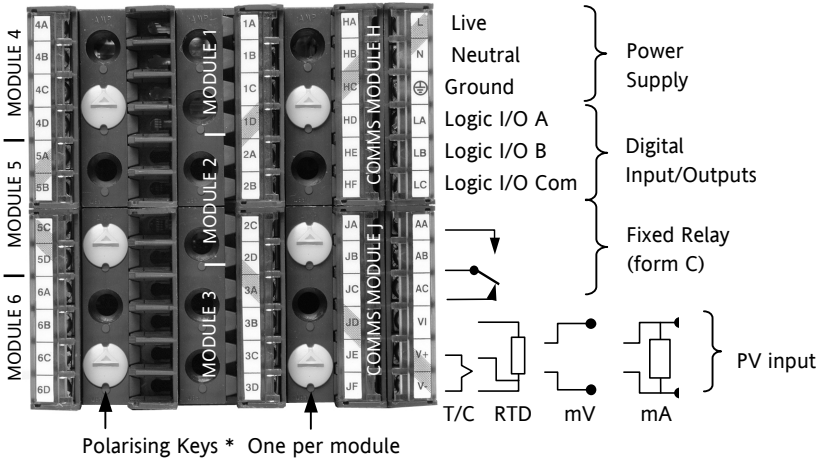
The controller can be unplugged from its sleeve by easing the latching ears outwards and pulling it forward out of the sleeve. When plugging it back into its sleeve, ensure that the latching ears click back into place to maintain the IP65 sealing.

1.4 Electrical Connections

3508



3504



* Polarising Keys.

Polarising keys are intended to prevent modules which are not supported in this controller from being fitted into the controller. An example might be an unisolated module (coloured red) from a 2400 controller series. When pointing towards the top, as shown, the key prevents a controller, fitted with an unsupported module, from being plugged into a sleeve which has been previously wired for isolated modules. If an unisolated module is to be fitted, it is the users responsibility to ensure that it is safe to install the controller in the particular application. When this has been verified the polarising key may be adjusted with a screwdriver to point in the down direction.

1.4.1 Wire Sizes

The screw terminals accept wire sizes from 0.5 to 1.5 mm (16 to 22AWG). Hinged covers prevent hands or metal making accidental contact with live wires. The rear terminal screws should be tightened to 0.4Nm (3.5lb in).

1.5 Standard Connections

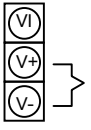
These are connections which are common to all instruments in the range.

1.5.1 PV Input (Measuring Input)

Notes:

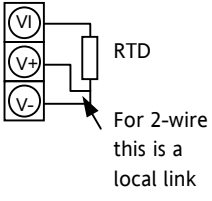
1. Do not run input wires together with power cables
2. When shielded cable is used, it should be grounded at one point only
3. Any external components (such as zener barriers, etc) connected between sensor and input terminals may cause errors in measurement due to excessive and/or un-balanced line resistance or possible leakage currents

1.5.1.1 Thermocouple or Pyrometer Input



Use the correct type of thermocouple compensating cable, preferably shielded, to extend wiring

1.5.1.2 RTD Input

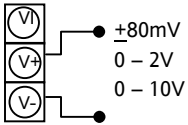


The resistance of the three wires must be the same

The line resistance may cause errors if it is greater than 22Ω

Note: the RTD wiring is not the same as 2400 series instruments. It is the same as 26/2700 series

1.5.1.3 Linear Input V, mV and High Impedance V



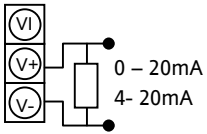
mV range ±40mV or ±80mV

High level range 0 – 10V

High Impedance mid level range 0 – 2V

A line resistance for voltage inputs may cause measurement errors

1.5.1.4 Linear Input mA



Connect the supplied load resistor equal to 2.49Ω for mA input

The resistor supplied is 1% accuracy 50ppm

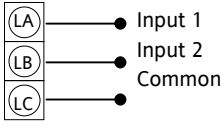
A resistor 0.1% accuracy 15ppm resistor can be supplied as an orderable option

1.5.2 Digital I/O

These terminals may be configured as logic inputs, contact inputs or logic outputs in any combination. It is possible to have one input and one output on either channel.

⚠ **The Digital IO is not isolated from the PV input**

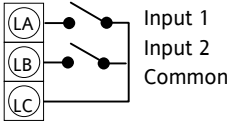
1.5.2.1 Logic Inputs



Voltage level logic inputs, 12V, 5-40mA

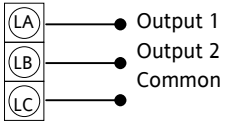
Active > 10.8V
Inactive < 7.3V

1.5.2.2 Contact Closure Inputs



Contact open > 1200Ω
Contact closed < 480Ω

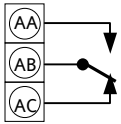
1.5.3 Digital (Logic) Outputs



The logic outputs are capable of driving SSR or thyristors up to 9mA, 18V
It is possible to parallel the two outputs to supply 18mA, 18V.

Note : The Digital IO terminals are not isolated from the PV.

1.5.4 Relay Output



Relay rating, min: 1V, 1mAdc. Max: 264Vac 2A resistive

Relay shown in de-energised state

1.5.4.1 General Note About Inductive Loads

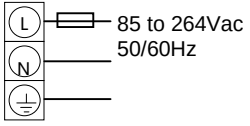
High voltage transients may occur when switching inductive loads such as some contactors or solenoid valves.

For this type of load it is recommended that a 'snubber' is connected across the contact of the relay switching the load. The snubber typically consists of a 15nF capacitor connected in series with a 100Ω resistor and will also prolong the life of the relay contacts.

⚠ When the relay contact is open and it is connected to a load, the snubber passes a current (typically 0.6mA at 110Vac and 1.2mA at 240Vac. It is the responsibility of the installer to ensure that this current does not hold on the power to an electrical load. If the load is of this type the snubber should not be connected.

See also section 1.7.9.

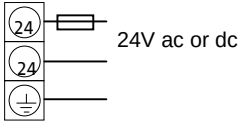
1.5.5 Power Supply Connections



1. Before connecting the instrument to the power line, make sure that the line voltage corresponds to the description on the identification label
2. For supply connections use 16AWG or larger wires rated for at least 75°C
3. Use copper conductors only
4. For 24V the polarity is not important
5. It is the Users responsibility to provide an external fuse or circuit breaker.

   For 24 V ac/dc fuse type T rated 4A 250V

   For 85/265Vac fuse type T rated 1A 250V



Safety requirements for permanently connected equipment state:

- a switch or circuit breaker shall be included in the building installation
- it shall be in close proximity to the equipment and within easy reach of the operator
- it shall be marked as the disconnecting device for the equipment

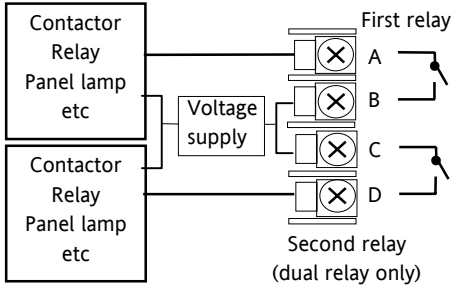
Note: a single switch or circuit breaker can supply more than one instrument

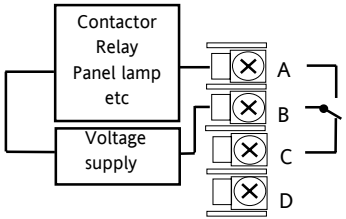
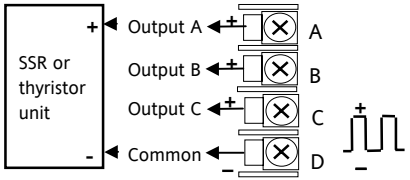
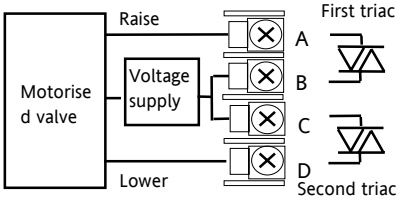
1.6 Plug in I/O Module Connections

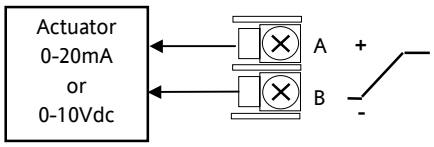
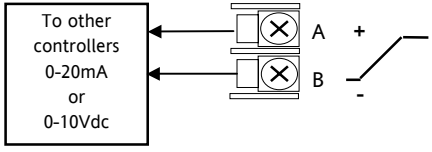
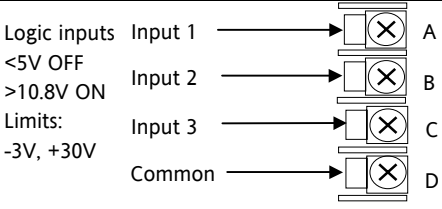
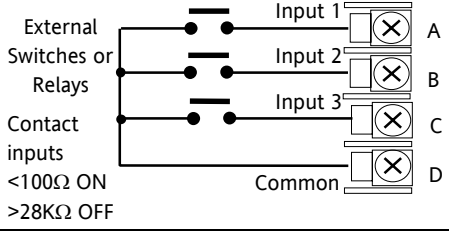
Plug in I/O modules can be fitted in three positions in the 3508 and six positions in 3504. The positions are marked Module 1, 2, 3, 4, 5, 6. With the exception of the Analogue Input module, any other module listed in this section, can be fitted in any of these positions. To find out which modules are fitted check the ordering code printed on a label on the side of the instrument. If modules have been added, removed or changed it is recommended that this is recorded on the instrument code label.

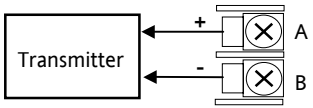
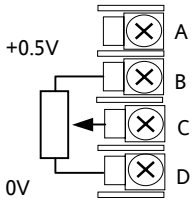
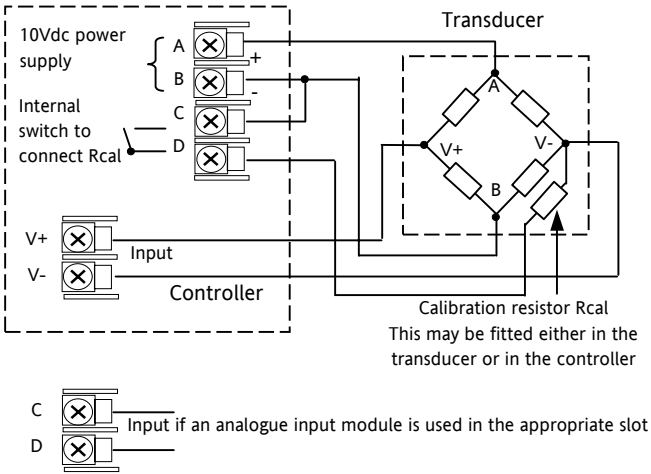
The function of the connections varies depending on the type of module fitted in each position and this is shown below. All modules are isolated.

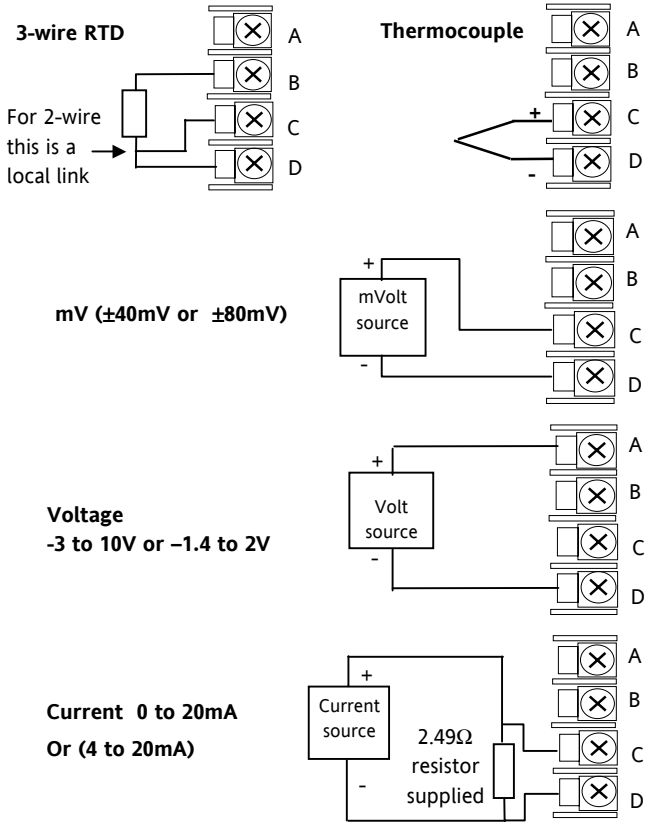
1.6.1 I/O Modules

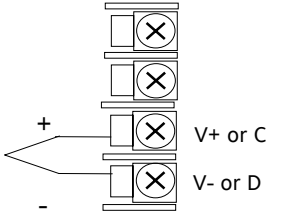
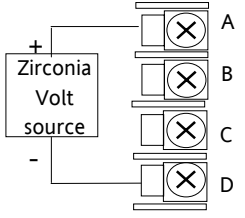
I/O Module	Typical usage	H/W Code	Connections and examples of use
Note: The order code and terminal number is pre-fixed by the module number. Module 1 is connected to terminals 1A, 1B, 1C, 1D; module 2 to 2A, 2B, 2C, 2D, etc.			
Relay (2 pin) and Dual Relay 2A, 264Vac max 1mA 1V min	Heating, cooling, alarm, program event, valve raise, valve lower	R2 and RR	

I/O Module	Typical usage	H/W Code	Connections and examples of use
Change Over Relay (2A, 264Vac max) 1mA 1V min	Heating, cooling, alarm, program event, valve raise, valve lower	R4	
Triple Logic Output (18Vdc at 8mA max.)	Heating, cooling, program events	TP	
Triac and Dual Triac (0.7A, 30 to 264Vac combined rating)	Heating, cooling, valve raise, valve lower	T2 and TT	 Note 1: Dual relay modules may be used in place of dual triac. **Note 2:-** **The combined current rating for the two triacs must not exceed 0.7A.**

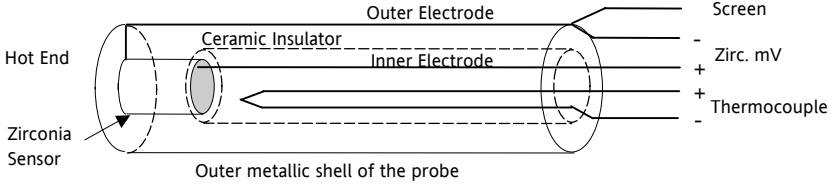
I/O Module	Typical usage	H/W Code	Connections and examples of use
DC Control (10Vdc, 20mA max)	Heating, cooling e.g. to a 4-20mA process actuator	D4	
DC Re-transmission (10Vdc, 20mA max)	Logging of PV, SP, output power, etc., (0 to 10Vdc, 0 to 20mA)	D6	
Triple Logic Input	Events e.g. Program Run, Reset, Hold	TL	
Triple Contact Input	Events e.g. Program Run, Reset, Hold	TK	

I/O Module	Typical usage	H/W Code	Connections and examples of use
24V Transmitter Supply (20mA)	To power an external transmitter	MS	
Potentiometer input 100Ω to 15KΩ			
Transducer Power Supply Configurable 5V or 10Vdc Minimum load resistance 300Ω			 10Vdc power supply Internal switch to connect Rcal A B C D + - V+ V- Input Controller Transducer A B V+ V- Calibration resistor Rcal This may be fitted either in the transducer or in the controller C D Input if an analogue input module is used in the appropriate slot

I/O Module	Typical usage	H/W Code	Connections and examples of use
Anologue Input (T/C & RTD) **Modules 1, 3, 4 & 6 only** (mV, V and mA)	Second or third PV input	AM	

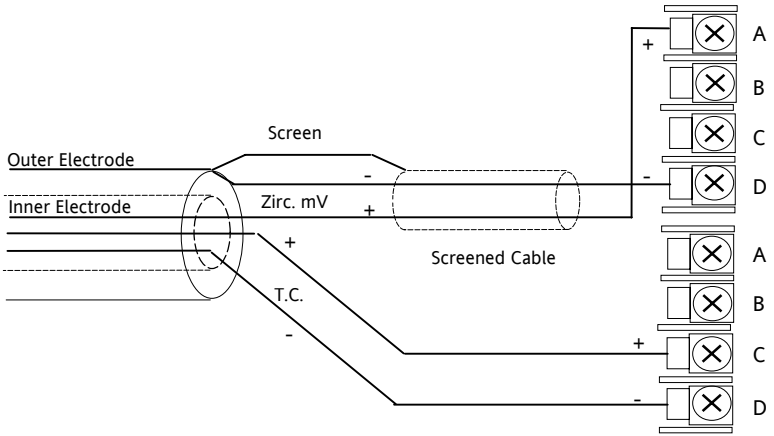
I/O Module	Typical usage	H/W Code	Connections and examples of use
Anologue Input (T/C & RTD) **Modules 1, 3, 4 & 6 only** PV Input Module **Modules 1, 3, 4 & 6 only**	Zirconia Probe	AM PV	The temperature sensor of the zirconia probe can be connected to the Fixed PV input, terminals V+ and V-, or to an Analogue Input module, terminals C & D. The Volt Source connected to an Analogue Input module, terminals A & D.  Fixed PV (or an Analogue Input Module)  Analogue Input Module

1.6.2 Zirconia Probe Construction



1.6.3 Zirconia Probe Screening Connections

The zirconia sensor wires should be screened and connected to the outer shell of the probe if it is situated in an area of high interference.



1.7 Digital Communications Connections

Digital Communications modules can be fitted in two positions in both 3508 and 3504 controllers. The connections being available on HA to HF and JA to JF depending on the position in which the module is fitted. The two positions could be used, for example, to communicate with 'iTools' configuration package on one position, and to a PC running a supervisory package on the second position.

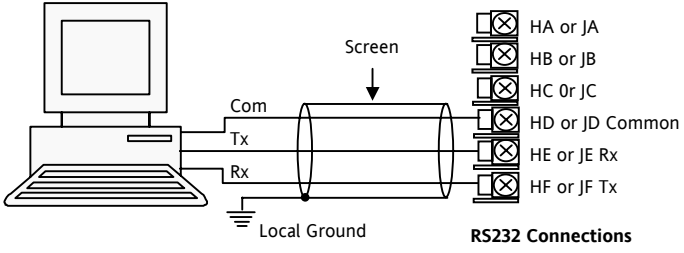
Communications protocols may be ModBus, EIBisynch, DeviceNet, Profibus or Ethernet.

Note:- In order to reduce the effects of RF interference the transmission line should be grounded at both ends of the screened cable. However, if such a course is taken care must be taken to ensure that differences in the earth potentials do not allow circulating currents to flow, as these can induce common mode signals in the data lines. Where doubt exists it is recommended that the Screen (shield) be grounded at only one section of the network as shown in all of the following diagrams.

1.7.1 Modbus Slave (H or J Module) or EIBisynch

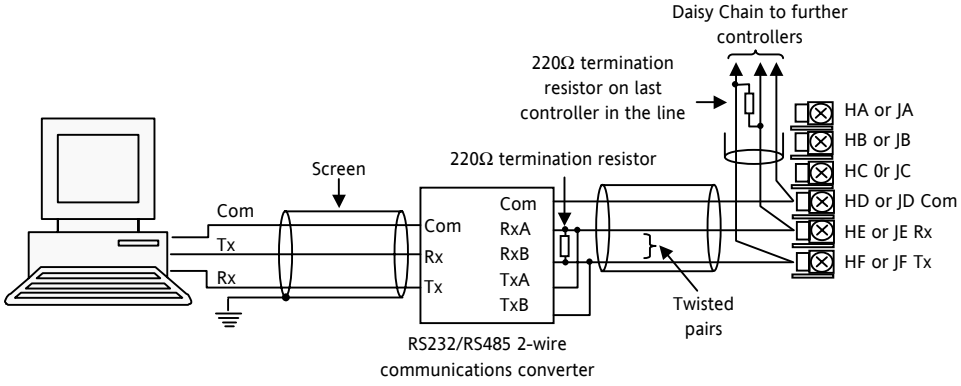
A further description of ModBus and EIBisynch communications is given in 2000 series Communications Handbook, Part No. HA026230.

RS232 Connections



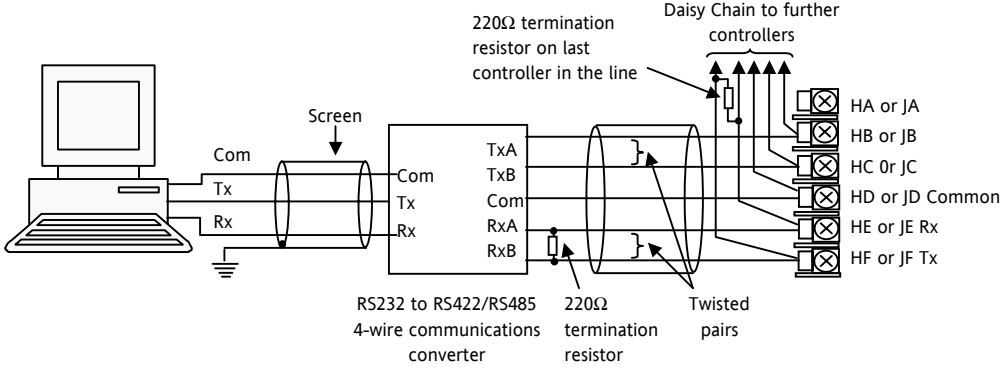
RS232 Connections

RS485 2-Wire Connections



The KD485 communications converter is recommended for interfacing to RS485. This unit is also used to buffer an RS485 network when it is required to communicate with more than 32 instruments on the same bus, and may also be used to bridge 2-wire RS485 to 4-wire RS422.

RS422/RS485 4-Wire Connections



The 261 or KD485 communications converter is recommended for:
Interfacing 4-wire to 2-wire connections.
To buffer an RS422/485 network when more than 32 instruments on the same bus are required
To bridge 2-wire RS485 to 4-wire RS422.

1.7.2 Devicenet Wiring

A description of DeviceNet is given in the DeviceNet Communications Handbook Part No HA027506 which can be downloaded from www.eurotherm.co.uk.

Terminal Reference	CAN Label	Color Chip	Description
HA	V+	Red	DeviceNet network power positive terminal. Connect the red wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect to the positive terminal of an external 11-25 Vdc power supply.
HB	CAN_H	White	DeviceNet CAN_H data bus terminal. Connect the white wire of the DeviceNet cable here.
HC	SHIELD	None	Shield/Drain wire connection. Connect the DeviceNet cable shield here. To prevent ground loops, the DeviceNet network should be grounded in only one location.
HD	CAN_L	Blue	DeviceNet CAN_L data bus terminal. Connect the blue wire of the DeviceNet cable here.
HE	V-	Black	DeviceNet network power negative terminal. Connect the black wire of the DeviceNet cable here. If the DeviceNet network does not supply the power, connect to the negative terminal of an external 11-25 Vdc power supply.
HF			Connect to instrument earth

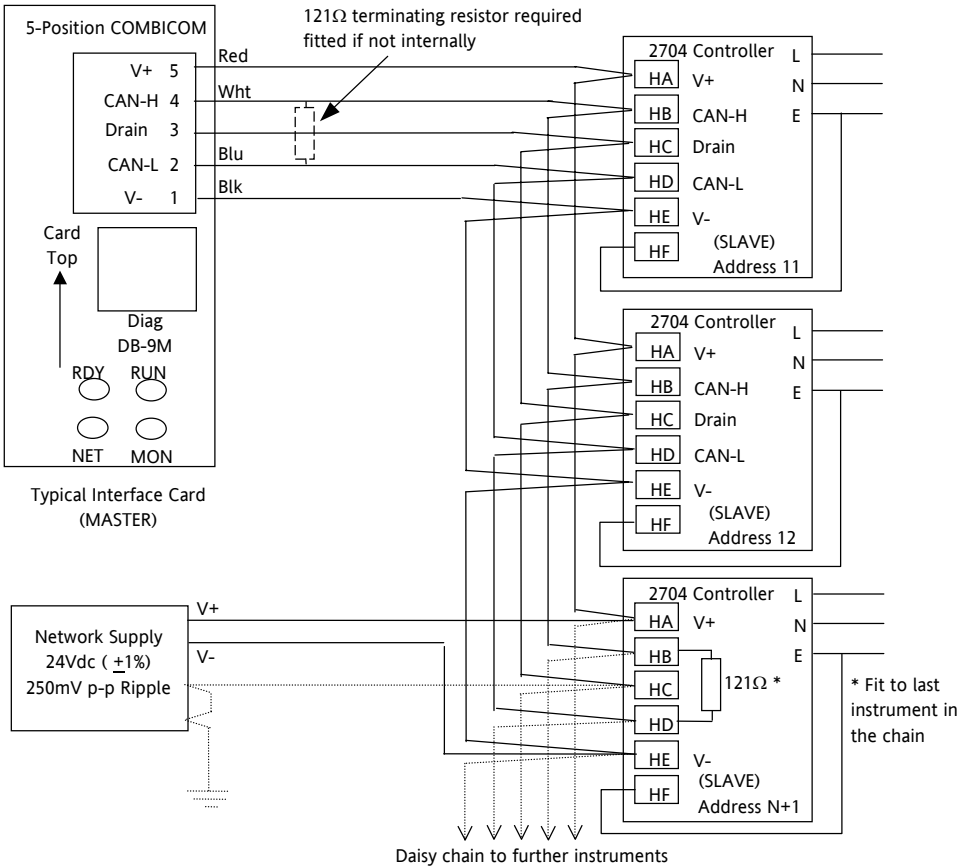
Note: Power taps are recommended to connect the DC power supply to the DeviceNet trunk line. Power taps include:

A Schottky Diode to connect the power supply V+ and allows for multiple power supplies to be connected.

2 fuses or circuit breakers to protect the bus from excessive current which could damage the cable and connectors.

The earth connection, HF, to be connected to the main supply earth terminal.

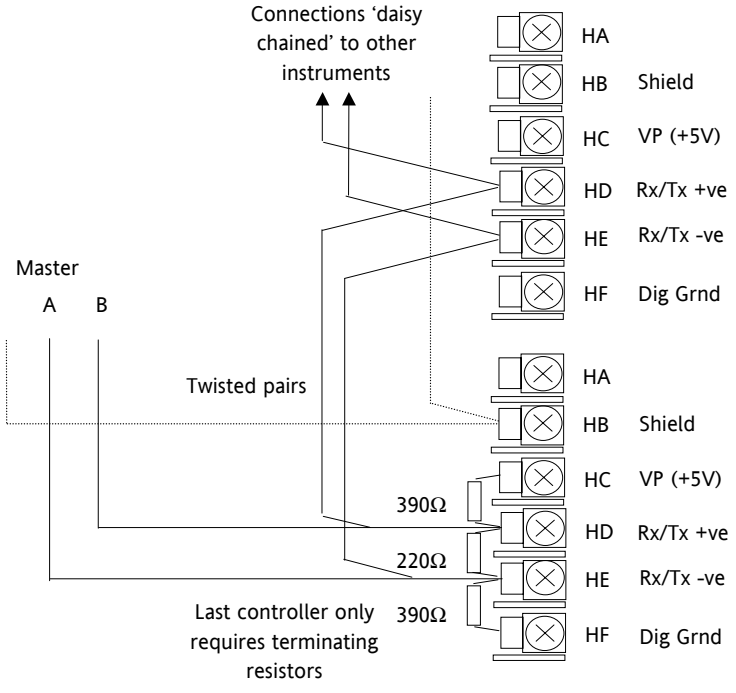
1.7.3 Example Devicenet Wiring Diagram



1.7.4 Profibus

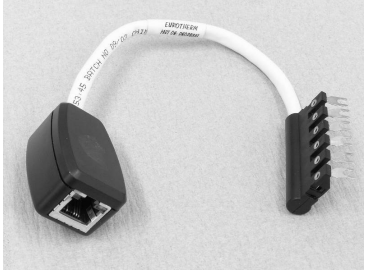
A description of ProfiBus is given in the ProfiBus Communications Handbook Part No HA026290 which can be downloaded from www.eurotherm.co.uk.

1.7.5 Example Profibus Wiring

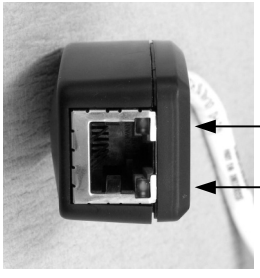


1.7.6 Ethernet

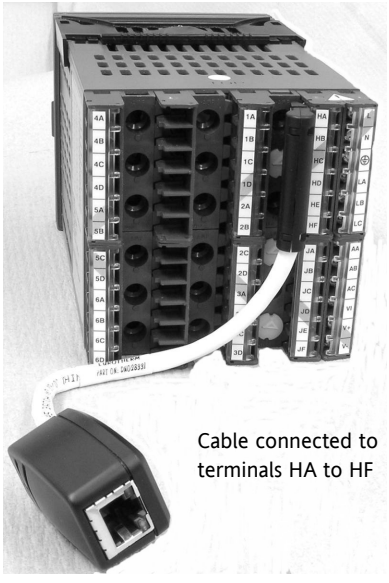
When the controller is supplied with the Ethernet communications option a special cable assembly is also supplied. This cable must be used since the magnetic coupling is contained within the RJ45 connector. It consists of an RJ45 connector (socket) and a termination assembly which must be connected to terminals HA to HF.



View of cable which may also be ordered separately as Part No SUB3500/COMMS/EA



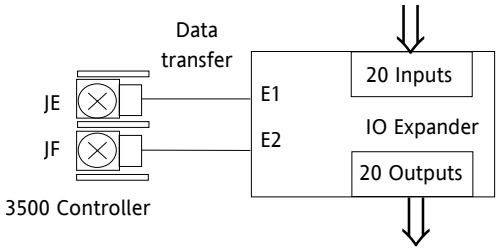
Activity and power on LED indicators



Cable connected to terminals HA to HF

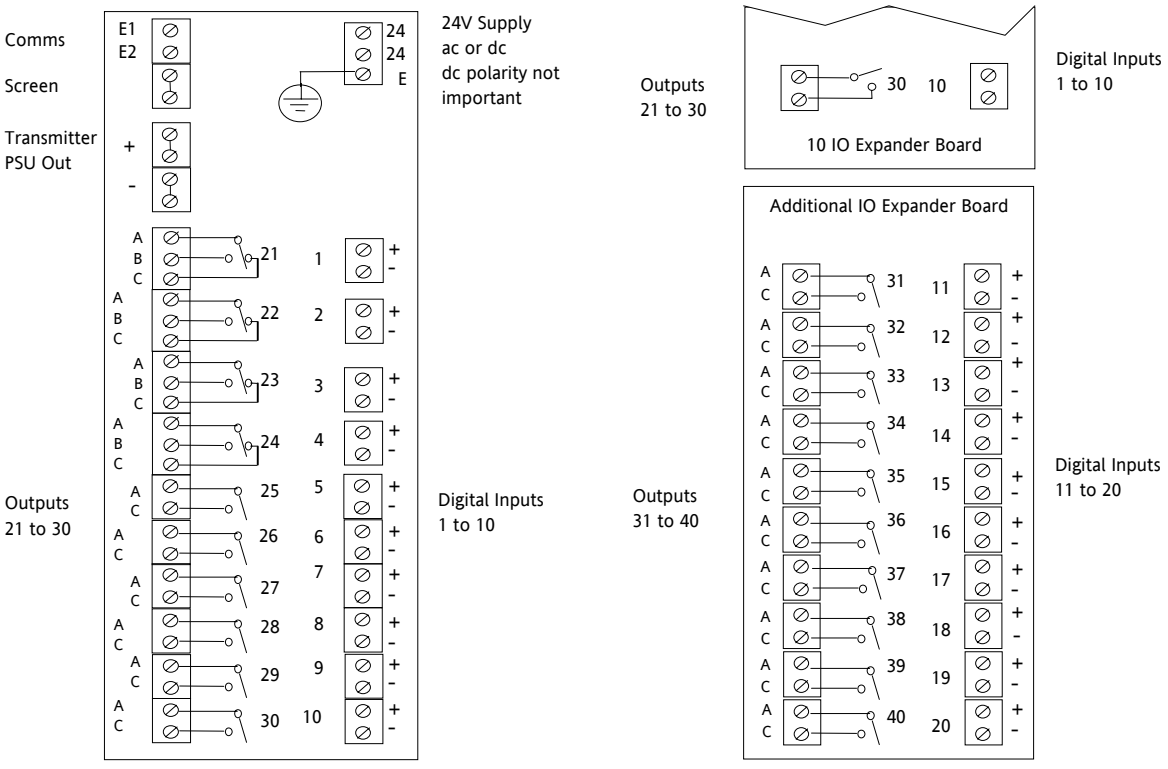
1.7.7 I/O Expander (or Additional Digital Input)

An I/O expander (Model No 2000IO) can be used with 3500 series controllers to allow the number of I/O points to be increased by up to a further 20 digital inputs and 20 digital outputs. Data transfer is performed serially via a two wire interface module which is fitted in digital communications slot J.

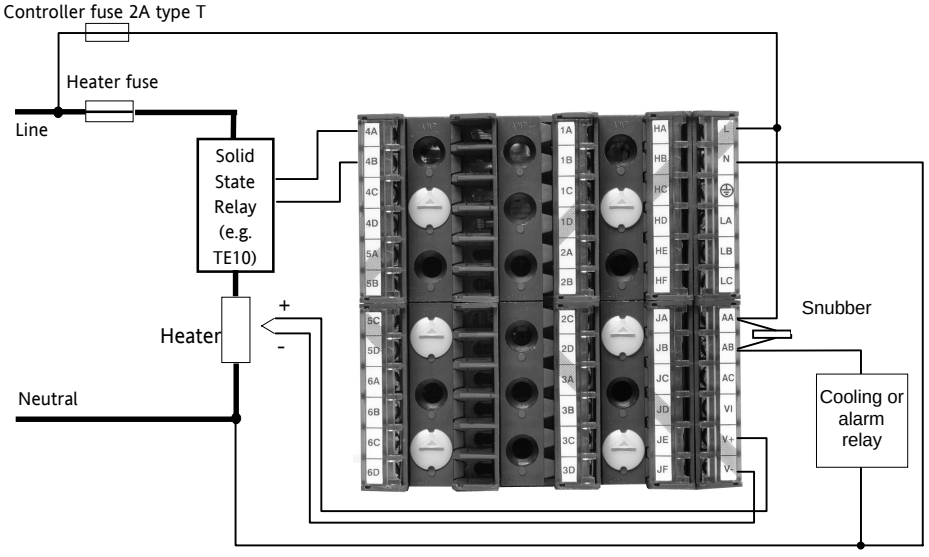


For details of the IO Expander refer to the Operating Instructions HA026893. The connections for this unit are reproduced below for convenience.

1.7.8 IO Expander Connections



1.7.9 Example Wiring Diagram



Please refer to the EMC Electromagnetic Compatibility Handbook Part No. HA025464 for details of good wiring practice. This can be downloaded from www.eurotherm.co.uk.

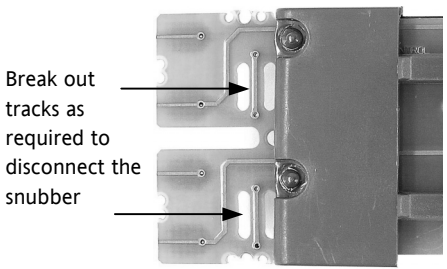
1.7.10 Snubbers

Snubbers are used to prolong the life of relay contacts and to reduce interference when switching inductive devices such as contactors or solenoid valves. The fixed relay (terminals AA/AB/AC) is not fitted internally with a snubber and it is recommended that a snubber be fitted externally, as shown in the example wiring diagram. If the relay is used to switch a device with a high impedance input, no snubber is necessary.

All relay modules are fitted internally with a snubber since these are generally required to switch inductive devices. However, snubbers pass 0.6mA at 110V and 1.2mA at 230Vac, which may be sufficient to hold on high impedance loads. If this type of device is used it will be necessary to remove the snubber from the circuit.

The snubber is removed from the relay module as follows:-

1. Unplug the controller from its sleeve
2. Remove the relay module
3. Use a screwdriver or similar tool to snap out the track. The view below shows the tracks in a Dual Relay Output module.



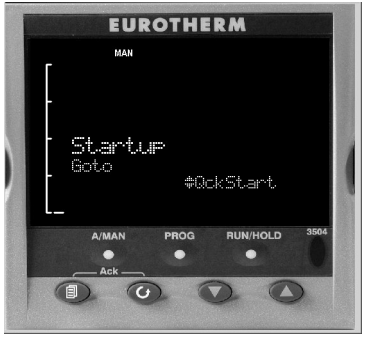
2. Chapter 2: Getting Started

A brief start up sequence consists of a self test in which all elements of the display are illuminated and the software version is shown. What happens next depends on one of two conditions;-

1. Power up out of the box – when the controller has no preset configuration and is switched on for the very first time it will start up in 'QuickStart mode. This is an intuitive tool for configuring the controller and is described in section 2.1 below.
2. The controller has been powered up previously and is already configured. In this case go to section 2.3.

2.1 Quick Start - New Controller (Unconfigured)

When the controller is switched on for the very first time it will display the 'Startup' screen shown below.



Controller Display 3504 3508

* Manual mode is always selected when in Quick Start mode because the controller resets to cold start when Quick Start is selected.

2.1.1 To Configure Parameters in Quick Start Mode

Press ▲ or ▼ to select Quick Start Mode or Configuration Mode. **'Config'** will allow you to enter full configuration mode, covered in detail in later sections of this handbook.

Press ○ to scroll through the list of parameters

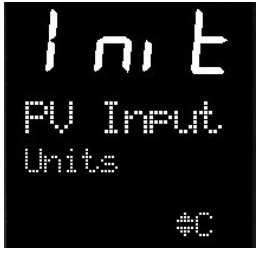
Edit the parameters using the ▲ or ▼ buttons

Each time ○ button is pressed a new parameter will be presented

This is illustrated by the following example:- (The views shown are taken from the 3508 controller but the same information is included in the 3504).

☺ Backscroll – to scroll back through parameters press and hold ○ then press ▲ to go back through the list of parameters. You can also press and hold ○ + ▼ to go forward - this has the same effect as pressing ○ alone.

Example

Do This	Display	Additional Notes
1. From the Start view press 2. Press or to change the **'Units'** 3. A different parameter is selected each time is pressed.		The first parameter to be configured is **'Units'**. It resides in the '**PV Input List'** because it is associated with the process variable. When the required choice is selected a brief blink of the display indicates that it has been accepted
4. Continue setting up the parameters presented until the **'Finished'** view is displayed. 5. If all parameters are set up as required press or to **'Yes'**		If you wish to scroll around the parameters again do not select Yes but continue to press . When you are satisfied with the selections select 'Yes'. The display will then show the 'HOME' display shown in section 2.3

The following table summarises all the parameters which can be set up by the above procedure.

2.1.2 Quick Start Parameters

Parameters shown in **Bold** are defaults.

Group	Parameter	Value	Availability
PV Input	Units Used to select the engineering units for the PV	**C**, F, K V. mV, A, mA, pH, mmHg, psi, Bar, mBar, %RH, %, mmWG, inWG, inWW, Ohms, PSIG, %O2, PPM, %CO2, %CP, %/sec, mBar/Pa/T, sec, min, hrs, None	Always
PV Input	Resolution Used to select the required decimal point position for the PV	**XXXXX**, XXXX.X, XXX.XX, XX.XXX, X.XXXX	Always
PV Input	Range Type Used to select the linearisation algorithm required and the input sensor.	Thermocouple: J, **K**, L, R, B, N, T, S, PL2, C. RTD: Pt100 Linear: 0-50mV, 0-5V, 1-5V, 0-10V, 2-10V, 0-20mA, 4-20mA	Always
PV Input	Range High Configures the maximum display range and SP limits	Depends on Range type selected. Default **1200**	Always
PV Input	Range Low Configures the minimum display range and SP limits	Depends on Range type selected. Default **0**	Always
Loop	Control Channel 1 Sets the control type for channel 1 (normally Heat)	**PID,** VPU, VPB, Off, OnOff	Always
Loop	Control Channel 2 Sets the control type for channel 2 (normally Cool)	PID, VPU, VPB, **Off,** OnOff	Always

Group	Parameter	Value	Availability
LgcIO LA	Logic OP (or IP) function The LA Logic I/O port can be an output or an input. This parameter is used to select its function.	**Not Used,** Chan 1, Chan 2, Alarm 1 to 8, Any Alarm, New Alarm, ProgEvnt1 to 8, (outputs) Auto Man, AlarmAck, ProgRun, ProgReset, ProgHold (Inputs)	[Note 1] [Note 2]
LgcIO LA	Min OnTime This applies to both LA and LB inputs	**Auto** 0.01 to 150.00	Only appears if Control Channel = VPB and the channel is allocated to the LA output [Note 2]
LgcIO LB	Logic OP (or IP) function The LB Logic I/O port can be an output or an input. This parameter is used to select its function.	**Not Used** All parameters the same as LA I/O	Only appears if Control Channel = VPB and the channel is allocated to the LB output [Note 2]
RlyOP AA	Relay function This relay is always fitted.	**Not Used,** Chan 1, Chan 2, Alarm 1 to 8, Any Alarm, New Alarm, ProgEvnt1 to 8	Always. [Note 3]

Note 1) Parameters only appear if the function has been turned on, eg If 'Control Channel 1' = 'Off', 'Chan 1' does not appear in this list. When a control channel is configured for valve positioning, LgcIO LA and LgcIO LB act as a complementary pair. If, for example, Chan 1 is connected to LgcIO LA (valve raise) then LgcIO LB is automatically set to Chan 1 (valve lower). This ensures the valve is never raised and lowered simultaneously.

The same complementary behaviour also applies to dual output modules and channels A and C of triple output modules

Note 2) If any input function, for example Chan 1, is connected to another input it will not appear in this list

Note 3) For valve position control Chan 1 or Chan 2 will not appear in this list. Valve position outputs can only be dual outputs such as LA and LB or dual relay/triac output modules

Modules

The following parameters configure the plug in I/O modules. I/O Modules can be fitted in any available slot in the instrument (6 slots in 3504, 3 slots in 3508). The controller automatically displays parameters applicable to the module fitted - if no module is fitted in a slot then it does not appear in the list.

Each module can have up to three inputs or outputs. These are shown as A, B or C after the module number and this corresponds to the terminal numbers on the back of the instrument. If the I/O is single only A appears. If it is dual A and C appears if it is triple A, B and C appear.

Module type	Parameter	Value		Availability
Change over relay (R4) **2 pin relay (R2)** **Triac output (T2)**	Relay (Triac) function	**Not Used** All parameters the same as RlyOP AA		Always (if the module is fitted)
Dual Relay (RR) **Dual triac output (TT)**	Relay (Triac) function	**Not Used** All parameters the same as RlyOP AA		Always (if the module is fitted)
	Relay function	**Not Used** All parameters the same as RlyOP AA		Always (if the module is fitted)
Single Logic Output (LO)	Logic Out function	**Not Used** All parameters the same as RlyOP AA		Always (if the module is fitted)
Triple Logic Output (TP)	Logic OP function	**Not Used** All parameters the same as RlyOP AA		Always (if the module is fitted)
DC Output (D4) **DC Retransmission (D6)**	DC Output function	**Not Used** Chan 1 Chan 2 SP Retran PV Retran ErrRtran PwrRtran	Module fitted but not configured Channel 1 control output Channel 2 control output Setpoint retransmission Process variable retransmission Error Retransmission Power output retransmission	Always (if the module is fitted)

Module type	Parameter	Value		Availability
	Range Type	**0–5V,** 1-5V, 1–10V, 2–10V, 0-29mA, 4-20mA		
	Display High	**100.0**		
	Display Low	**0**		
Triple Logic Input (TL) **Triple Contact Input (TK)**	Logic Input function	**Not Used** Auto Man AltSP Sel AlarmAck ProgRun ProgReset ProgHold	Module fitted but not configured Auto/manual Alternative SP select Alarm acknowledge Programmer run Programmer reset Programmer hold	A function can only be allocated to one input. eg if AlarmAck is configured on X*A it is not offered for the other inputs * is the module number
Analogue Input (AM)	Analogue IP function	**Not Used** Loop PV Remote SP RemOPH RemOPL ch1VlvPos ch2VlvPos	Module fitted but not configured Loop process variable Remote setpoint Remote output power maximum Remote output power minimum To read valve position from feedback potentiometer	ch1VlvPos and ch2VlvPos only appear if the control channel 1 or control channel 2 is set to VPB. Remote SP does not appear if the programmer option is supplied
	Range Type	Thermocouple: J, **K**, L, R, B, N, T, S, PL2, C. RTD: Pt100 Linear: 0-50mV, 0-5V, 1-5V, 0-10V, 2-10V, 0-20mA, 4-20mA		Not shown if analogue IP function not used
Potentiometer Input (VU)	Pot Input function	**Not Used** Loop PV Remote SP	Module fitted but not configured Loop process variable Remote setpoint	Ch1VlvPos/Ch2VlvPos only appear if the channel = VPB Remote SP does not

Module type	Parameter	Value		Availability
		RemOPH RemOPL Ch1VlvPos Ch2VlvPos	Remote output power maximum Remote output power minimum Channel 1 valve position Channel 1 valve position	appear if the programmer option is supplied
Transducer Power Supply (G3)	TdcrPSU function	**5 Volts** 10 Volts		Always (if the module is fitted)
Transmitter power supply (M5)	No parameters. Used to show the ID of the module if fitted			

Alarms

Group	Parameter	Value		Availability
Alarm 1 to 8	Type	**None** Abs High Abs Low Dev High Dev Low Dev Band	No alarm type configured Absolute high Absolute low Deviation high Deviation low Deviation band	Always
Alarm 1 to 8	Source	**None** PV Input Loop PV ModX Ip	Not connected Connected to process variable Connected to loop process variable for deviation alarms Connected to a suitable module eg Analog IP (X = module number)	Always if Type ≠ None PV Input and ModX Ip do not appear if Type = Deviation
Alarm 1 to 8	Setpoint	To adjust the alarm threshold within the range of the source.		Always if Type ≠ None
Alarm 1 to 8	Latch	**None** Auto Manual Event	No latching Automatic latching see section 2.7.1 Manual latching see section 2.7.1 Alarm beacon does not light but any output associated with the event will activate and a scrolling message will appear.	Always if Type ≠ None

Finished	Exit	**No** Yes	Continue back around the quick configuration list Go to normal operation	

2.2 To Re-enter Quick Start Mode

If you have exited from Quick Start mode (by selecting 'Yes' to the 'Finished' parameter) and you need to make further changes, the Quick start mode can be entered again at any time. The action which takes place depends on one of two previous conditions as follows:-

2.2.1 Power up After a Quick Start Configuration

1. Hold ⊜ down then power up the controller. Keep this button pressed until the Quick start screen as shown in section 2.1 is displayed.
2. Press ⊙ to enter the quick start list. You will then be asked to enter a passcode.
3. Use ▲ or ▼ to enter the passcode – default 4 – the same as the configuration level passcode. If an incorrect code is entered the display reverts to the 'Quick Start' view section 2.1.

It is then possible to repeat the quick configuration as described previously.
The Quick Start view shown in section 2.1 now contains an additional parameter - **'Cancel'**. This is now always available after a power up, and, if selected, will take you into normal operating mode, section 2.3.

2.2.2 Power up After A Full Configuration

Repeat 1,2 and 3 above.

Full configuration allows a greater number of parameters to be configured in a deeper level of access. This is described in the Engineering Handbook Part No. HA027988.

If the controller has been re-configured in this level, a **'WARNING'** message, **'Delete config?'** - **'No'** or **'Yes'**, will be displayed. If 'No' is selected the display drops back to the 'GoTo' screen.

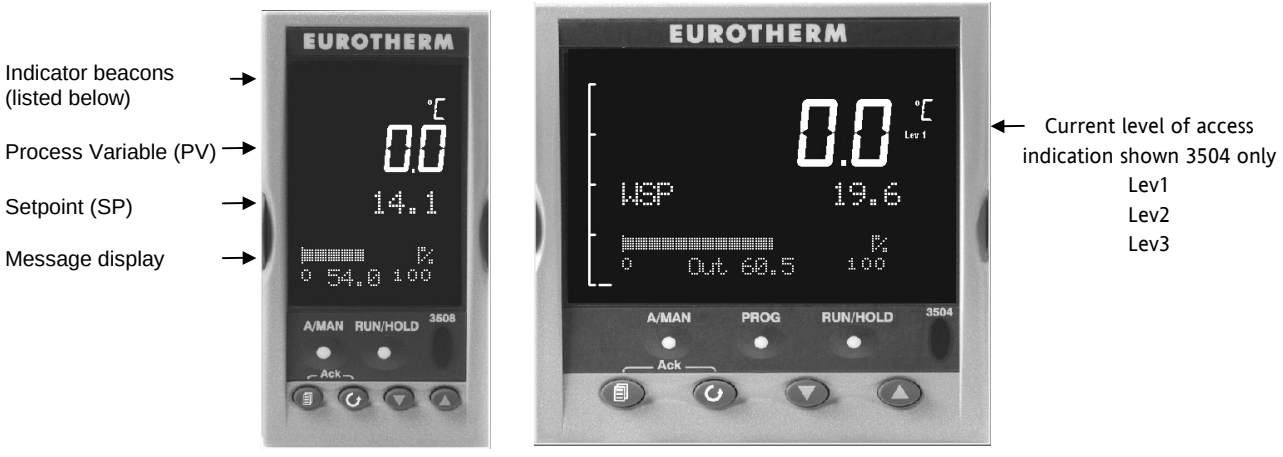
1. Use ▲ or ▼ to select 'Yes'
2. Press ⊙ to confirm or ⊜ to cancel. (If no button is pressed for about 10 seconds the display returns to the WARNING message).

If 'Yes' is selected the **Quick start defaults** will be re-instated. It is then necessary to reset **all** the Quick start parameters.

2.3 Normal Operation

Switch on the controller. Following a brief self-test sequence, the controller will start up in AUTO mode and Operator Level 1. This section describes the operation of the controller in this level.

AUTO is the normal closed loop temperature control mode which means that the output power is adjusted automatically by the controller in response to the measurement from the input sensor. In this mode the format of the display for a new instrument is shown below. It is called the HOME display.



3508 **3504**

2.3.1 Beacon Display and Description

OP1	Illuminates when output 1 is ON (normally heating)
OP2	Illuminates when output 2 is ON (normally cooling or alarm)
MAN	Illuminates when manual mode active
REM	Illuminates when remote setpoint active
SPX	Illuminates when alternative setpoint active
ALM	If an alarm occurs the red alarm beacon flashes. This is accompanied by a message showing the source of the alarm, for example 'Boiler overheating'. To acknowledge press ⟲ and ▼. The message disappears. If the alarm condition is still present the beacon lights continuously. When cleared it will extinguish. A full description of the alarm operation is given in section 2.7
RUN	Illuminates when programmer running – flashing indicates End
HLD	Illuminates when programmer held
J	Flashes when J Channel comms active
H	Flashes when H Channel comms active
IR	Flashes when infra red communications active

In general throughout this handbook instrument views will use the 3504. The displayed information is similar for the 3508 but in some cases is shortened due to display limitations.

2.4 The Operator Buttons

Page Scroll Lower Raise

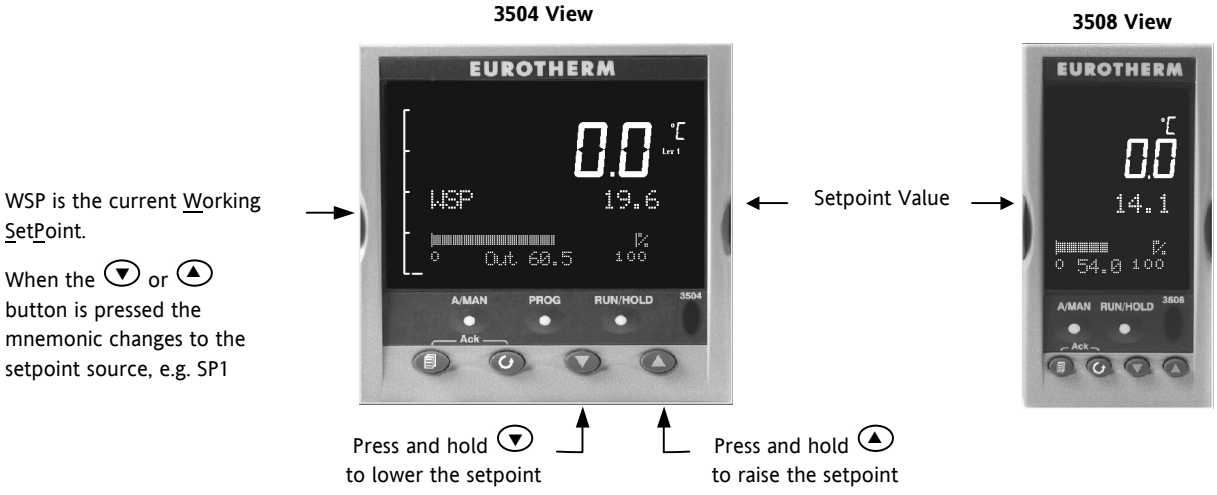
A/MAN This button can be disabled	Manual operation means that the controller output power is adjusted by the user. The input sensor is still connected and reading the PV but the control loop is open. When pressed, this toggles between automatic and manual operation. • If the controller is in manual mode, 'MAN' light will be indicated If the controller is powered down in Manual operation it will resume this mode when it is powered up again.
PROG	To select the programmer summary page
RUN/HOLD This button can be disabled	• Press once to start a program. 'RUN' will be indicated • Press again to hold a program. 'HLD' will be indicated • Press and hold for at least two seconds to reset a program. 'RUN' will flash at the end of a program 'HLD' will flash during holdback Programmer operation is fully described in chapter 21 of the Engineering Manual
	Press to select new PAGE headings
	Press to select a new parameter in the page
	Press to decrease an analogue value, or to change the state of a digital value
	Press to increase an analogue value, or to change the state of a digital value

2.4.1 Shortcut Key Presses

Backpage	Press and hold ▲. Then press ☰. The page headers scroll backward at each press. (With ☰ still pressed you can press ▼ to page forward. This action is the same as pressing ☰ alone).
Backscroll	Press and hold ▲ when in a list. Then press ↻. Parameters scroll backward at each press. Press and hold ↻ when in a list header. Then press. ▼. Parameters scroll forward at each press.
Jump to the HOME display	Press ☰ + ↻
Alarm Ack/reset	Press ☰ + ↻ when the HOME screen is being displayed. All active alarms will be acknowledged

2.5 To Set The Required Temperature (Setpoint)

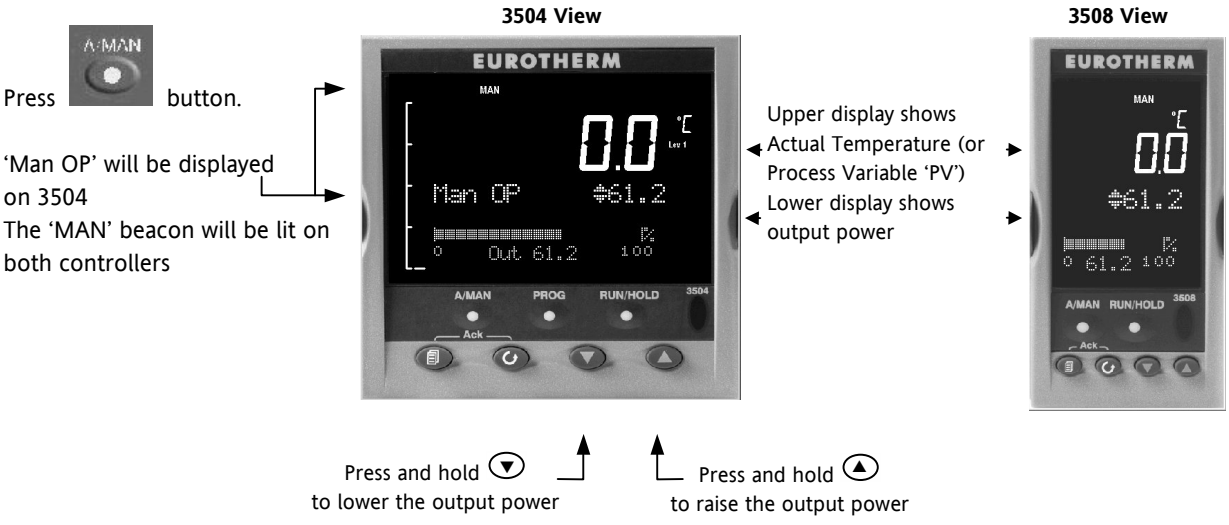
From the HOME display, press ▼ or ▲ button.



A momentary press of either button will show the setpoint in use eg SP1.

The new setpoint is accepted when the button is released and is indicated by a brief flash of the setpoint display

2.6 To Select Manual Operation



The output power will change continuously while either of these buttons are pressed

If the controller is powered down in either Auto or Manual operation it will resume the same mode when it is powered up again.

2.7 Alarm Indication

If an alarm occurs it is indicated as follows:-

The red alarm (ALM) beacon in the top left of the display flashes

Alarm number is indicated together with the flashing

A default message or a pre-programmed message appears showing the source of the alarm

Invitation to acknowledge the new alarm

2.7.1 To Acknowledge an Alarm

Press and **(Ack)** together.

The action, which now takes place, will depend on the type of latching, which has been configured

Non Latched Alarms

If the alarm condition is present when the alarm is acknowledged, the alarm beacon will be continuously lit. This state will continue for as long as the alarm condition remains. When the alarm condition disappears the indication will also disappear.

If a relay has been attached to the alarm output, it will de-energise when the alarm condition occurs and remain in this condition until the alarm is acknowledged **AND** it is no longer present.

If the alarm condition disappears before it is acknowledged the alarm indication disappears as soon as the condition disappears.

Automatic Latched Alarms

The alarm continues to be active until both the alarm condition is removed AND the alarm is acknowledged. The acknowledgement can occur **BEFORE** the condition causing the alarm is removed.

Manual Latched Alarms

The alarm continues to be active until both the alarm condition is removed AND the alarm is acknowledged. The acknowledgement can only occur **AFTER** the condition causing the alarm is removed.

2.8 Message Centre

The lower section of the HOME display contains an alpha-numeric set of messages. These messages change between different controller types and operating modes and are grouped in summary pages. The 3504 contains more information than the 3508, and generally the parameter descriptions are longer due to the larger display..

2.8.1 Summary Pages

Press . A set of pre-defined summary pages are shown at each press. These are typically a summary of programmer, loop and alarm operation. A further eight customised pages are also possible and these can be programmed off line using iTools programming software.

Loop Summary

The view opposite shows heat only.

For **heat/cool** the bar graph is bi-directional (± 100%) as shown below:-

For **valve position** control the user interface will display either heat only or heat/cool summary pages.

3504 **3508**

Press

At each press a new display will be shown

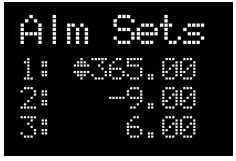
Programmer Summary

This display is only shown if the Programmer option has been enabled

Alarm Summary

Alarm Settings

All configured alarms will be listed



Control

2.8.2 How to Edit Parameters

In the above summary pages, press ⊙ to scroll to further parameters (where applicable).

Press ▼ or ▲ to change the value of the parameter selected.

Any parameter preceded by ⇕ is alterable provided the system is in a safe state to allow the parameter to be changed. For example, 'Program Number' cannot be changed if the program is running - it must be in 'Reset' or 'Hold' mode. If an attempt is made to alter the parameter its value is momentarily replaced by '---' and no value is entered.

Some parameters are protected under a higher level of security – Level 2. In these cases it will be necessary to select 'Access Level 2'. This is carried out as follows:-

1. Press and hold ⊙ until the display shows
2. Press ▲ to select Level 2
3. Press ▲ again to enter a security code. This is defaulted to 2. If an incorrect code is entered the display reverts to that shown in 1 above. If the default of 2 is not accepted this means that the code has been changed on your particular controller. It will be necessary to refer to the Engineering Handbook.
4. 'Pass' is displayed momentarily. You are now in Level 2.

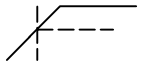
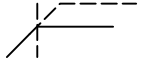
2.8.3 Programmer Summary Page

Provided it has been ordered and enabled the 3500 series controllers can program the rate of change of setpoint. Up to 50 programs and up to a maximum of 200 segments in total, can be stored and run. Chapter 21 explains setpoint programming in more detail.

2.8.3.1 To Select a Parameter

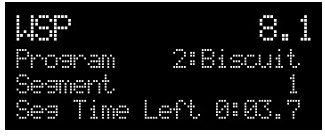
Press ⟲ to scroll through a list of parameters. On the 'Programmer Summary' shown here, the list of parameters which can be selected are:-

Parameter Name	Parameter Description	Value		Default	Available in Level
Program	Program number (and name if this has been configured)	1 to max number of programs		1	L1 Alterable when prog in reset
Segment	Segment number (and type on 3504) Only appears when the programmer is running	1 to max number of segments		1	L1
Seg Time Left	Segment Time Left Only appears when the programmer is running	hrs:mins:secs		Read only	L1
Status	Program Status	End Run Hold Holdback	Prog ended Prog running Prog held In holdback		L1
PSP	Profile setpoint value	Can be changed in Hold			L1

Parameter Name	Parameter Description	Value		Default	Available in Level
Cycles Left	Number of repeat cycles left to run Can only be changed in Hold or Reset	1 to maximum number of cycles set			L1 R/O in Run
Advance 	Sets the program setpoint equal to the target setpoint and moves to the next segment. Only operates when the programmer is running (not in Hold)	No Yes	This is a momentary action	No	L1
SkipSeg 	Moves immediately to the next segment and starts from the current setpoint value. Only operates when the programmer is running (not in Hold)	No Yes	This is a momentary action	No	L1
Fast Run	This is only available in level 3 as described in later chapters. Set to 'Yes' and then run the program. The programmer will run through the segments at a fast rate. It is intended to be used only to test a new program and should not be used on an active process	No Yes	Fast run disabled Fast run enabled		L3
Events or Rst Events	State of the event outputs when the program is running or when in reset	□ Event inactive ■ Event active			L1
Prg. TimeLeft	Time remaining to end of selected program	hrs:mins:secs			L1

2.8.3.2 To Select and Run a ProgramProfiBus

In this example it is assumed that the program to be run has already been entered. Setpoint programming is described in detail in Chapter 21 of the Engineering Handbook.

Do This	The Display You Should See	Additional Notes
1. From any display press ☰ until the 'Programmer User Display' is shown		
2. Press ↻ to **'Program'** 3. Press ▲ or ▼ to choose the program number to be run		In this example Program Number 2 is chosen and has been given a user defined name. In the 3504 Program names can be entered using the off-line programming package 'iTools'.
4. Press RUN or select 'Status' and set this to 'Run'		'RUN' is displayed in the indicator beacons section of the main display. The view shown here shows current working setpoint, program being run, current segment number and time left to complete this segment.
5. To Hold a program press RUN		Press RUN again to continue the program. When the program is complete 'RUN' will flash
6. To Reset a program press RUN for at least 3 seconds	'RUN' will extinguish and the controller will return to the HOME display. An alternative way to run, hold or reset the program is to scroll to 'Program Status' using ↻ and select 'Run', 'Hold' or 'Reset' using ▲ or ▼	

2.8.4 Alarm Summary Page

This page shows a summary of all analogue alarms. Press ⟳ to scroll through the alarms.

The diagram illustrates that an alarm is present in the system but that none of the alarms need acknowledgement.

A New Alarm occurs when any new alarm becomes active. This parameter may be used to activate a relay output to provide external audible or visual indication.

2.8.5 Alarms Setting Page

Up to eight analogue alarms can be configured. The alarm thresholds can be set in Level 2 in this page.

Press ⟳ to scroll through the alarms.

Press ▲ or ▼ to set the threshold values

Analogue alarm 1, configured as Absolute High and set to operate at 123.00
Analogue alarm 2, configured as Absolute Low and set to operate at -10.00

2.8.6 Control Summary Page

Parameters which define the way a control loop operates can be set in this page. Control parameters are further described in Chapter 20 of the Engineering handbook.

Press ⟳ to scroll through a list of parameters.

Press ▲ or ▼ to change the value of the selected parameter.

On the Control Summary page the following parameters are available:-

Parameter Name	Parameter Description	Value	Default	Available in Level
SP Select	To select SP1 or SP2	Between range limits set in higher levels of access	As order code	Lev1
SP1	To set the value of SP1			Lev1
SP2	To set the value of SP2			Lev1
SP Rate	To set the rate at which the setpoints change			Lev - alterable in Lev2
Tune (1)	To start self tuning	Off On	Off	
PB (1)	To set proportional band	0 to 99999		
Ti (1)	To set integral time	Off to 99999		
Td (1)	To set derivative time	Off to 99999		
R2G (1)	To set relative cool gain	0.1 to 10.0		
CBH (1)	To set cut back high	Auto to 99999		
CBL (1)	To set cut back low	Auto to 99999		
Output Hi	To set a high limit on the control output	-100.0 to 100.0%	100.0	
Output Lo	To set a low limit on the control output	-100.0 to 100.0%	0.0	

Parameter Name	Parameter Description	Value	Default	Available in Level
Ch1 OnOff Hyst	Channel 1 hysteresis (Only if configured for On/Off control)	0.0 to 200.0		Lev 1- alterable in Lev2
Ch2 OnOff Hyst	Channel 2 hysteresis (Only if channel 2 is configured and for On/Off control)	0.0 to 200.0		
Ch2 DeadB	Channel 2 deadband. To set the period in which there is no output from either channel. (This does not appear if channel 2 is not configured)	Off to 100.0		
Ch1 TravelT	Motor travel time if valve control output on channel 1	0.0 to 1000.0 seconds		
Ch1 TravelT	Motor travel time if valve control output on channel 1	0.0 to 1000.0 seconds		
Safe OP	To set an output level under sensor break conditions	-100.0 to 100.0%	0.0	

(1) Does not appear if control is configured for On/Off parameters

2.9 Introduction to Configuration using iTools

iTools is a PC based configuration package which is used to configure instruments. The controller may be connected to the PC in three ways:-

1. Using an infra red clip (IR) attached to the front fascia. Set the parameter 'IR Mode' in the 'Access' list to 'On'.

2. Using a configuration clip which plugs into the side of the controller

Both items are available from your supplier

3. Using a RS232, RS485 or RS422 digital communications interface connected to the H or J terminals

iTools provides:-

- Parameter Set up
- Device Operation
- Device Recipe
- Program Editing
- Configuration of User Pages
- Graphical Wiring
- Cloning

iTools and handbook part no HA026179 can be downloaded from www.eurotherm.co.uk.

2.9.1 Scan Function

With the controller connected, press

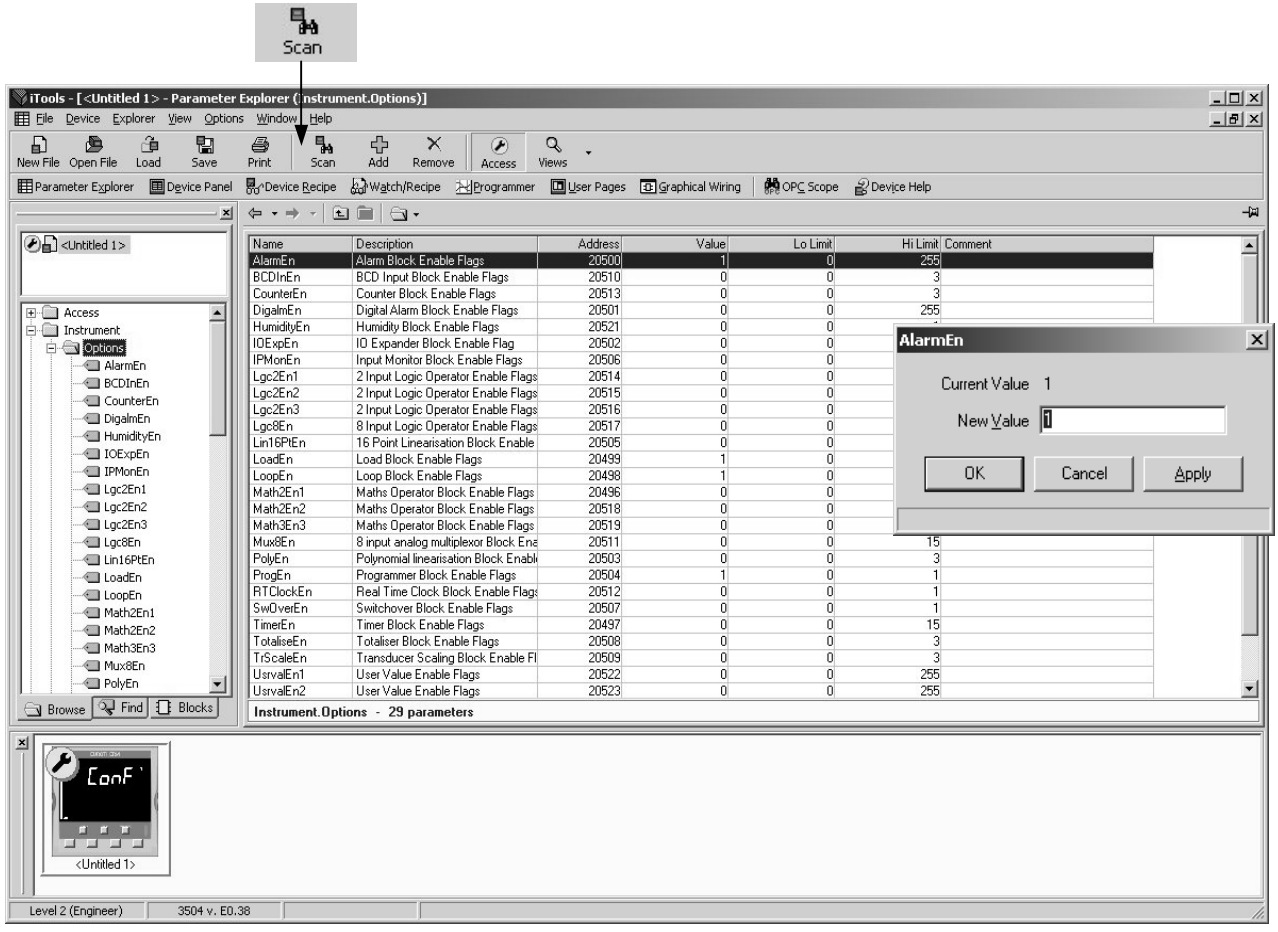
on the iTools menu bar. iTools will search the communications ports and TCPIP connections for recognisable instruments. Controllers connected with the configuration clip (CPI), will be found at address 255 regardless of the address configured in the controller.

2.9.2 Parameter Set Up

Allows parameters to be configured.

1. Press

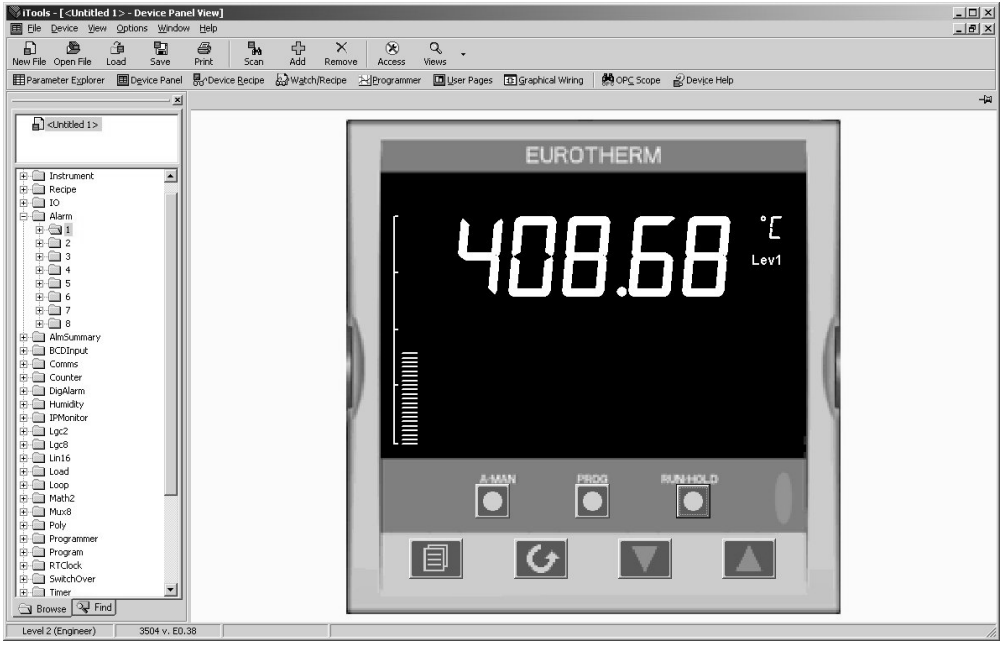
to get this view
2. Open up the parameter list by double clicking the required folder. Right click in the parameter list to reveal or hide columns.
3. To change the value of a parameter, double click the parameter and change its value using the pop-up window
4. The 'Access' button puts the controller into configuration mode. In this mode the controller can be set up without its outputs being active. Press 'Access' again to return to operating level.
5. The instrument view is optional. Select 'Panel Views' in the 'View' menu.
6. To find a parameter select the 'Find' tab.


Scan
iTools - [<Untitled 1> - Parameter Explorer (Instrument.Options)]
File Device Explorer View Options Window Help
New File Open File Load Save Print Scan Add Remove Access Views
Parameter Explorer Device Panel Device Recipe Watch/Recipe Programmer User Pages Graphical Wiring OPC Scope Device Help
<Untitled 1>
Access
Instrument
Options
AlarmEn
BCDInEn
CounterEn
DigalmEn
HumidityEn
IOExpEn
IPMonEn
Lgc2En1
Lgc2En2
Lgc2En3
Lgc8En
Lin16PtEn
LoadEn
LoopEn
Math2En1
Math2En2
Math3En3
Mux8En
PolyEn
Browse Find Blocks
Name Description Address Value Lo Limit Hi Limit Comment
AlarmEn Alarm Block Enable Flags 20500 1 0 255
BCDInEn BCD Input Block Enable Flags 20510 0 0 3
CounterEn Counter Block Enable Flags 20513 0 0 3
DigalmEn Digital Alarm Block Enable Flags 20501 0 0 255
HumidityEn Humidity Block Enable Flags 20521 0 0
IOExpEn IO Expander Block Enable Flag 20502 0 0
IPMonEn Input Monitor Block Enable Flags 20506 0 0
Lgc2En1 2 Input Logic Operator Enable Flags 20514 0 0
Lgc2En2 2 Input Logic Operator Enable Flags 20515 0 0
Lgc2En3 2 Input Logic Operator Enable Flags 20516 0 0
Lgc8En 8 Input Logic Operator Enable Flags 20517 0 0
Lin16PtEn 16 Point Linearisation Block Enable 20505 0 0
LoadEn Load Block Enable Flags 20499 1 0
LoopEn Loop Block Enable Flags 20498 1 0
Math2En1 Maths Operator Block Enable Flags 20496 0 0
Math2En2 Maths Operator Block Enable Flags 20518 0 0
Math3En3 Maths Operator Block Enable Flags 20519 0 0
Mux8En 8 input analog multiplexor Block Ena 20511 0 0 15
PolyEn Polynomial linearisation Block Enabl 20503 0 0 3
ProgEn Programmer Block Enable Flags 20504 1 0 1
RTClockEn Real Time Clock Block Enable Flags 20512 0 0 1
SwOverEn Switchover Block Enable Flags 20507 0 0 1
TimerEn Timer Block Enable Flags 20497 0 0 15
TotaliseEn Totaliser Block Enable Flags 20508 0 0 3
TrScaleEn Transducer Scaling Block Enable Fl 20509 0 0 3
UsrvalEn1 User Value Enable Flags 20522 0 0 255
UsrvalEn2 User Value Enable Flags 20523 0 0 255
Instrument.Options - 29 parameters
AlarmEn
Current Value 1
New Value 1
OK Cancel Apply
<Untitled 1>
Level 2 (Engineer)
3504 v. E0.38

2.10 Device panel

Press Device Panel for this feature. The Panel displays the active instrument panel. This can be used for remote viewing, diagnostics or Training. iTools can be used OFF-LINE to configure the product. The panel view gives an indication of how the instrument will appear when the configuration is downloaded.

The front panel control buttons, shown in the Device Panel display, are active and clicking on them with the mouse will cause the display to behave as a real instrument.

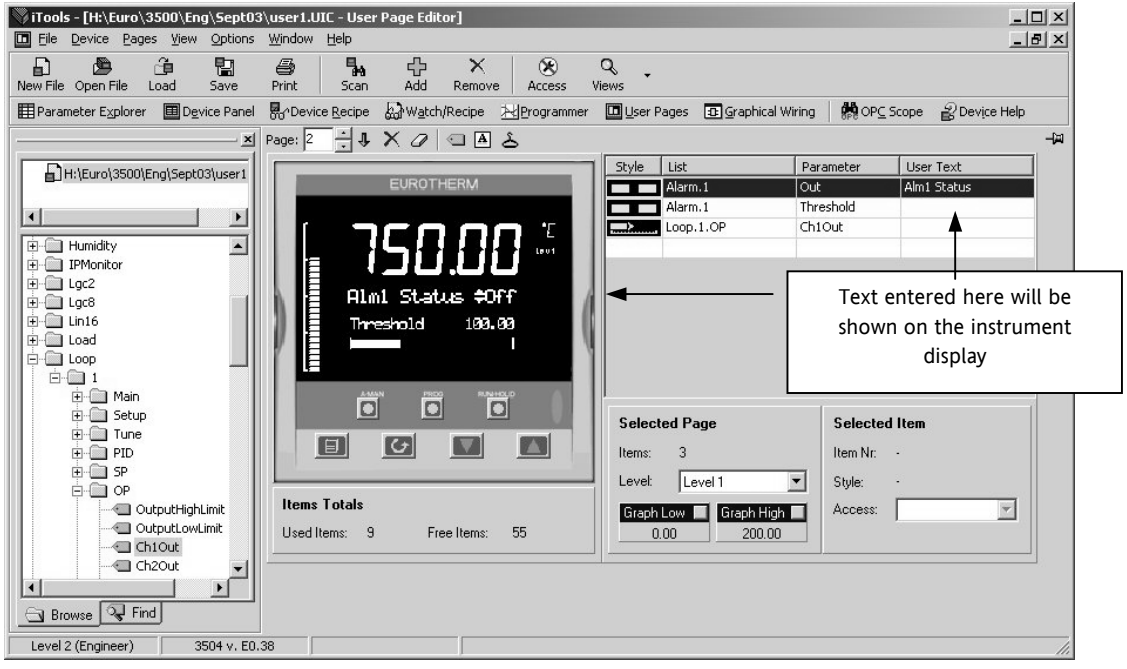


☺ Clicking on the Page button with Ctrl pressed emulates pressing the page and scroll buttons together.

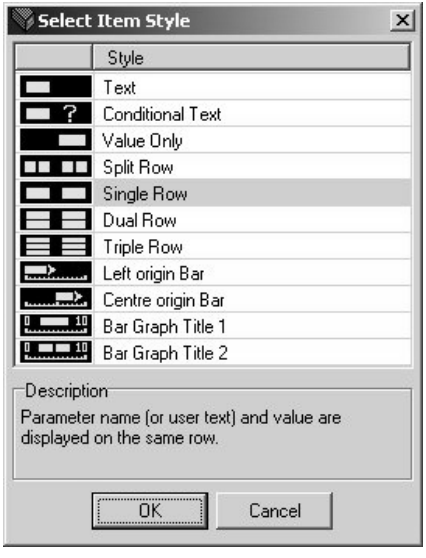
2.11 User Pages Editor

Up to 8 User Pages with a total of 64 lines can be created and downloaded into the controller so that the controller display shows only the information which is of interest to the user.

Press to select this feature

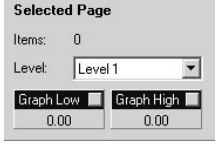


2.11.1 To create a User Page



1. Press

to select the page number 1 to 8
2. Drag and drop parameters from the browser to create the user parameter list
3. Choose the required style. The format is shown in the pop up window
4. Right click in the list to:
    a. Insert an item
    b. Remove an item
    c. Edit Wire. allows you to change the parameter selected
    d. Edit Text. Allows you to enter your own text for the parameter displayed
    e. Edit Style. This is shown in the pop up window
    f. Read Parameter Properties
    g. Open Parameter Help
5. Select the operator level at which the user page will be displayed



6. If a bar graph is displayed, set the low and high graph axes

The format of the user page is shown in the instrument view

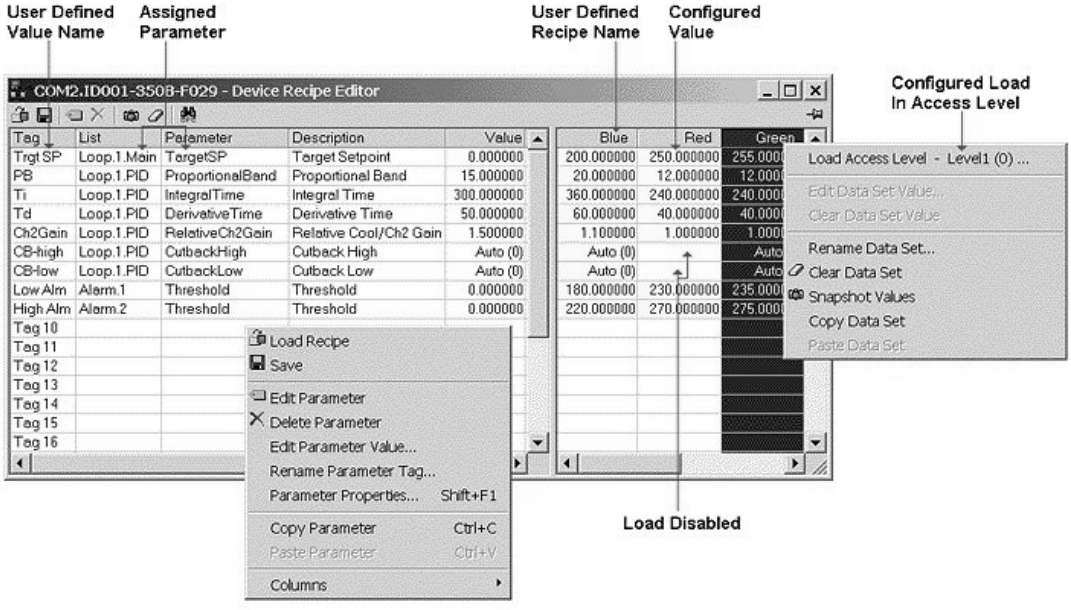
The user page can now be saved and downloaded to the instrument.

2.12 Recipe Editor in iTools

Press

for this feature. Up to 8 recipes can be stored. They can also be named by the user. Recipes allow the operator to change the operating values of up to 24 parameters in an instrument for different batch items/processes by simply selecting a particular recipe to load. Recipes are important for reducing error in setup and they remove the need for operator instructions fixed to the panel next to the instrument.

The Recipe Editor is used during configuration to assign the required parameters and to set up the values to be loaded for each recipe.



2.12.1.1 Recipe Menu Commands

Load Recipe	Used to load a recipe file into the instrument
Save	Used to save the current recipe configuration into a file
Edit Parameter	Used to assign a parameter to a Tag. Parameters can also be assigned by 'drag and drop' from the iTools parameter list
Delete Parameter	Used to delete an assigned parameter from the recipes
Edit Parameter Value	Used to edit the current value of the assigned parameter
Rename Parameter Tag	Allows the user to rename the Tag of the associated parameter. This tag is used on the instrument to identify assigned parameters (default Value1 - Value24)
Parameter Properties	Used to find the properties and help information of the selected parameter
Copy Parameter	Used to copy the currently selected parameter
Paste Parameter	Used to assign a previously copied parameter to the selected Tag
Columns	Used to hide/show the Description and Comment Columns
Load Access Level	Used to configure the lowest access level in which the selected recipe is allowed to load
Level1	Permitted to load when the instrument is in any of the access levels
Level2	Permitted to load when the instrument is in Level2, Level3 or Config access levels
Level3	Permitted to load when the instrument is in Level3 or Config access levels
Config	Permitted to load when the instrument is in the Config access level
Never	Never permitted to load

Note: Over comms, whilst the instrument is in operator mode, recipes that have been configured to load in Levels 1, 2 and 3 can be loaded. Whilst the instrument is in Config mode all recipes can be loaded.

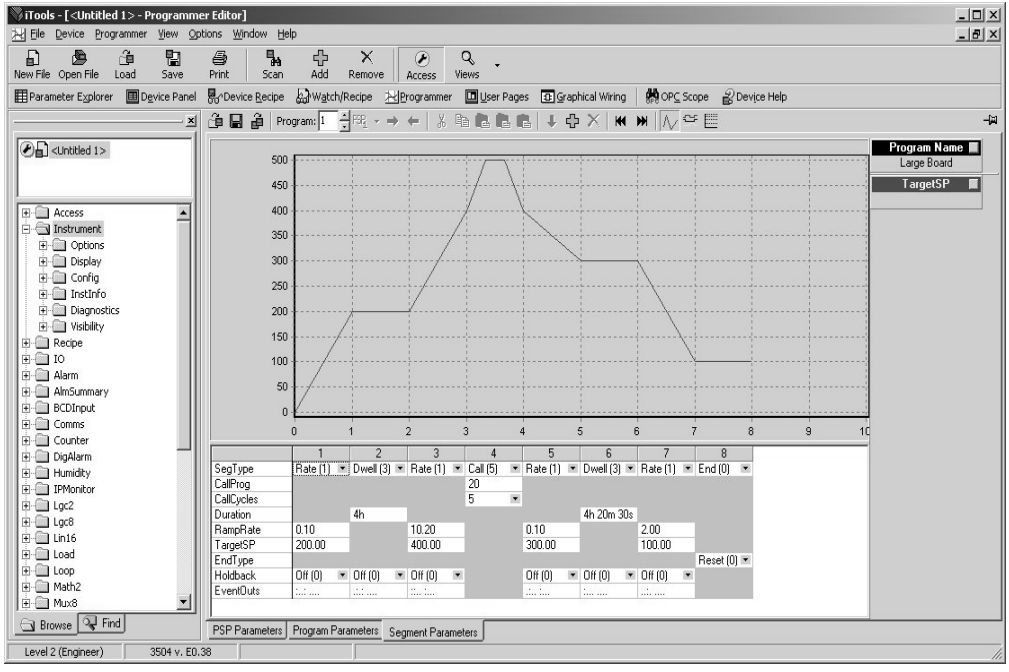
Edit Data Set Value	Used to edit the value of the selected assigned parameter within the selected recipe. Values can also be edited via double left clicking the value itself
Clear Data Set Value	Used to clear the value of the selected assigned parameter within the selected recipe, thus disabling it from loading when the recipe is selected to load
Rename Data Set	Allows the user to rename the selected recipe. This name is used to identify individual recipes (default Set1 - Set8). Note: Number of recipes dependent upon features
Clear Data Set	Used to clear all values in the selected recipe, thus disabling all from loading when the recipe is selected to load
Snapshot Values	Used to copy all of the assigned parameters current values into the selected recipe
Copy Data Set	Used to copy all values of the selected recipe
Paste Data Set	Used to paste all values of a previously copied recipe into the selected recipe

2.13 Program Editor

Setpoint programs can be created graphically, stored and downloaded into the controller.

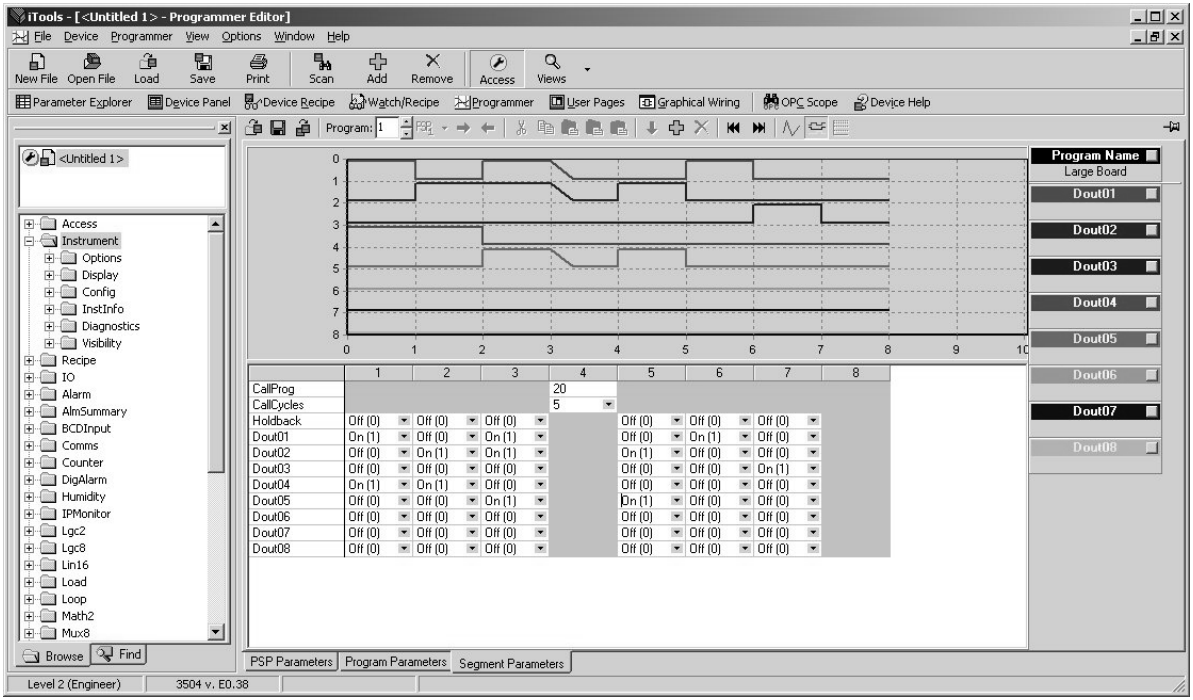
2.13.1 Analog View

1. Press Programmer to edit the analog setpoints
2. Select a program number using Program: 1
3. Double click Program Name and enter a name for the program
4. Right click in the blank area and choose 'Add Segment'
5. Select 'Segment Type' from the drop down and enter the segment details
6. Repeat for all required segments


iTools - [<Untitled 1> - Programmer Editor]
File Device Programmer View Options Window Help
New File Open File Load Save Print Scan Add Remove Access Views
Parameter Explorer Device Panel Device Recipe Watch/Recipe Programmer User Pages Graphical Wiring OPC Scope Device Help
Program: 1
Program Name
Large Board
TargetSP
SegType Rate (1) Dwell (3) Rate (1) Call (5) Rate (1) Dwell (3) Rate (1) End (0)
CallProg 20
CallCycles 5
Duration 4h 4h 20m 30s
RampRate 0.10 10.20 0.10 2.00
TargetSP 200.00 400.00 300.00 100.00
EndType Reset (0)
Holdback Off (0) Off (0) Off (0) Off (0) Off (0) Off (0)
EventOuts
PSP Parameters Program Parameters Segment Parameters
Level 2 (Engineer) 3504 v. E0.38

2.13.2 Event Outputs

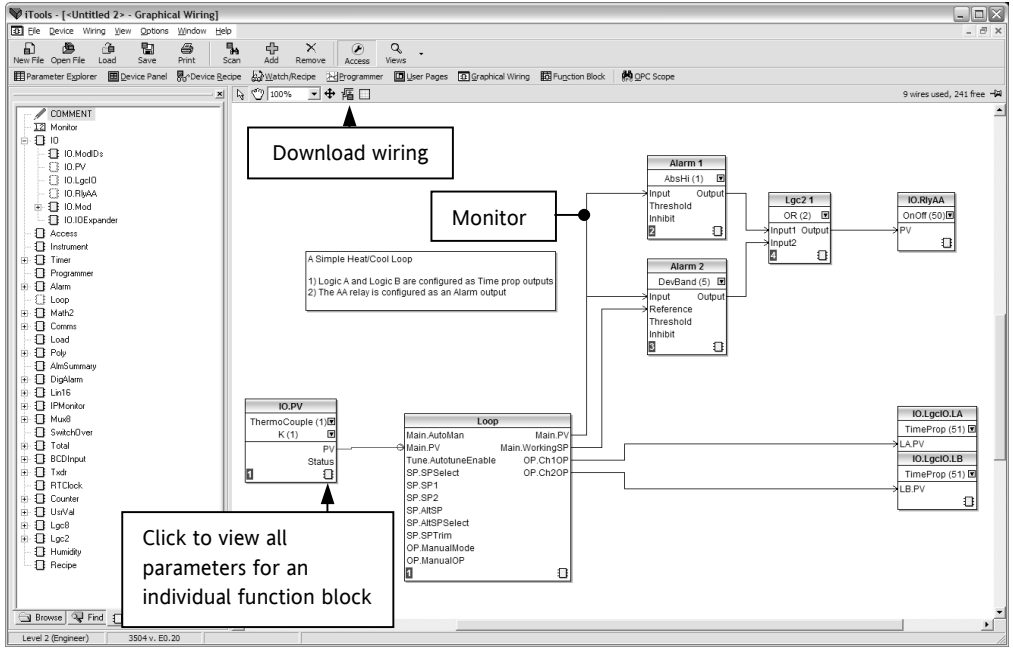
1. Press to select the digital events view.
2. Right click in the blank area to 'Add Segment'
3. Use the pull downs to turn the digital event On or Off in the selected segment



2.14 Graphical Wiring Editor

Select Graphical Wiring (GWE) to view and edit instrument wiring. You can also add comments and monitor parameter values.

1. Drag and drop required function blocks into the graphical wiring from the list in the left pane
2. Click on parameter to be wired from and drag the wire to the parameter to be wired to (do not hold mouse button down)
3. Right click to edit parameter values
4. Add comments and notes
5. Add monitor points


Download wiring
Monitor
Click to view all parameters for an individual function block
A Simple Heat/Cool Loop
1) Logic A and Logic B are configured as Time prop outputs
2) The AA relay is configured as an Alarm output

2.14.1 Function Block

A Function Block is an algorithm which may be wired to and from other function blocks to make a control strategy. The Graphical Wiring Editor groups the instrument parameters into function blocks. Examples are: a control loop and a mathematical calculation.

Each function block has inputs and outputs. Any parameter may be wired from, but only parameters that are alterable may we wired to.

A function block includes any parameters that are needed to configure or operate the algorithm.

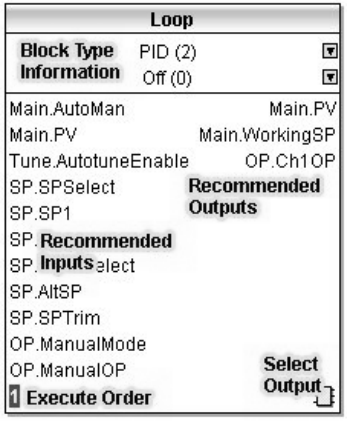
2.14.2 Wire

A wire transfers a value from one parameter to another. They are executed by the instrument once per control cycle.

Wires are made from an output of a function block to an input of a function block. It is possible to create a wiring loop, in this case there will be a single execution cycle delay at some point in the loop. This point is shown on by a || symbol and it is possible to choose where that delay will occur.

Dotted lines around a function block show that it requires downloading.

2.14.3 Using Function Blocks



If a function block is not faded in the tree then it can be dragged onto the diagram. The block can be dragged around the diagram using the mouse.

A labelled loop block is shown here. The label at the top is the name of the block.

When the block type information is alterable click on the box with the arrow in it on the right to edit that value.

The inputs and outputs which are considered to be of most use are always shown. In most cases all of these will need to be wired up for the block to perform a useful task. There are exceptions to this and the loop is one of those exceptions.

If you wish to wire from a parameter which is not shown as a recommended output click on the icon in the bottom right and a full list of parameters in the block will be shown, click on one of these to start a wire.

To start a wire from a recommended output just click on it.

Click 'Select Output' to wire new parameters

3. Chapter 3 Safety and EMC Information

This controller is manufactured in the UK by Eurotherm Ltd.

Please read this section carefully before installing the controller

This controller is intended for industrial temperature and process control applications when it will meet the requirements of the European Directives on Safety and EMC. Use in other applications, or failure to observe the installation instructions of this handbook may impair safety or EMC. The installer must ensure the safety and EMC of any particular installation.

3.1 GENERAL

The information contained in this manual is subject to change without notice. While every effort has been made to ensure the accuracy of the information, your supplier shall not be held liable for errors contained herein.

3.1.1 Safety

This controller complies with the European Low Voltage Directive 73/23/EEC, by the application of the safety standard EN 61010.

3.1.2 Electromagnetic compatibility

This controller conforms with the essential protection requirements of the EMC Directive 89/336/EEC, by the application of appropriate product specific international standards . This instrument satisfies the general requirements of the industrial environment defined in EN 61326. For more information on product compliance refer to the Technical Construction File.

3.1.3 Unpacking and storage

The packaging should contain an instrument mounted in its sleeve, two mounting brackets for panel installation and an Installation & Operating guide. Certain ranges are supplied with an input adapter.

If on receipt, the packaging or the instrument are damaged, do not install the product but contact your supplier. If the instrument is to be stored before use, protect from humidity and dust in an ambient temperature range of -10°C to +70°C.

3.2 Service and repair

This controller has no user serviceable parts. Contact your supplier for repair.

3.2.1 Caution: Charged capacitors

Before removing an instrument from its sleeve, disconnect the supply and wait at least two minutes to allow capacitors to discharge. It may be convenient to partially withdraw the instrument from the sleeve, then pause before completing the removal. In any case, avoid touching the exposed electronics of an instrument when withdrawing it from the sleeve.

Failure to observe these precautions may cause damage to components of the instrument or some discomfort to the user.

3.2.2 Electrostatic discharge precautions

When the controller is removed from its sleeve, some of the exposed electronic components are vulnerable to damage by electrostatic discharge from someone handling the controller. To avoid this, before handling the unplugged controller discharge yourself to ground.

3.2.3 Cleaning

Do not use water or water based products to clean labels or they will become illegible. Isopropyl alcohol may be used to clean labels. A mild soap solution may be used to clean other exterior surfaces of the product.

3.3 Installation Safety Requirements

3.3.1 Safety Symbols

Various symbols are used on the instrument, they have the following meaning:

Caution, (refer to accompanying documents)

3.3.2 Personnel

Installation must only be carried out by suitably qualified personnel.

3.3.3 Enclosure of live parts

To prevent hands or metal tools touching parts that may be electrically live, the controller must be installed in an enclosure.

3.3.4 *Caution:* Live sensors

The controller is designed to operate with the temperature sensor connected directly to an electrical heating element. However you must ensure that service personnel do not touch connections to these inputs while they are live. With a live sensor, all cables, connectors and switches for connecting the sensor must be mains rated.

The logic IO is not isolated from the PV inputs.

3.3.5 Wiring

It is important to connect the controller in accordance with the wiring data given in this guide. Take particular care not to connect AC supplies to the low voltage sensor input or other low level inputs and outputs. Only use copper conductors for connections (except thermocouple inputs) and ensure that the wiring of installations comply with all local wiring regulations. For example in the UK use the latest version of the IEE wiring regulations, (BS7671). In the USA use NEC Class 1 wiring methods.

3.3.6 Power Isolation

The installation must include a power isolating switch or circuit breaker. The device should be mounted in close proximity to the controller, within easy reach of the operator and marked as the disconnecting device for the instrument.

3.3.7 Overcurrent protection

The power supply to the system should be fused appropriately to protect the cabling to the units.

3.3.8 Voltage rating

The maximum continuous voltage applied between any of the following terminals must not exceed 264Vac:

- relay output to logic, dc or sensor connections;
- any connection to ground.

The controller must not be wired to a three phase supply with an unearthed star connection. Under fault conditions such a supply could rise above 264Vac with respect to ground and the product would not be safe.

3.3.9 Conductive pollution

Electrically conductive pollution must be excluded from the cabinet in which the controller is mounted. For example, carbon dust is a form of electrically conductive pollution. To secure a suitable atmosphere, install an air filter to the air intake of the cabinet. Where condensation is likely, for example at low temperatures, include a thermostatically controlled heater in the cabinet.

This product has been designed to conform to BSEN61010 installation category II, pollution degree 2. These are defined as follows:-

3.3.10 Installation Category II

The rated impulse voltage for equipment on nominal 230V supply is 2500V.

3.3.10.1 Pollution Degree 2

Normally only non conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation shall be expected.

3.3.11 Grounding of the temperature sensor shield

In some installations it is common practice to replace the temperature sensor while the controller is still powered up. Under these conditions, as additional protection against electric shock, we recommend that the shield of the temperature sensor is grounded. Do not rely on grounding through the framework of the machine.

3.3.12 Over-Temperature Protection

When designing any control system it is essential to consider what will happen if any part of the system should fail. In temperature control applications the primary danger is that the heating will remain constantly on. Apart from spoiling the product, this could damage any process machinery being controlled, or even cause a fire.

Reasons why the heating might remain constantly on include:

- the temperature sensor becoming detached from the process
- thermocouple wiring becoming short circuit;
- the controller failing with its heating output constantly on
- an external valve or contactor sticking in the heating condition
- the controller setpoint set too high.

Where damage or injury is possible, we recommend fitting a separate over-temperature protection unit, with an independent temperature sensor, which will isolate the heating circuit.

Please note that the alarm relays within the controller will not give protection under all failure conditions.

3.4 Installation Requirements for EMC

To ensure compliance with the European EMC directive certain installation precautions are necessary as follows:

- For general guidance refer to EMC Installation Guide, HA025464.
- When using relay outputs it may be necessary to fit a filter suitable for suppressing the conducted emissions. The filter requirements will depend on the type of load. For typical applications we recommend Schaffner FN321 or FN612.
- If the unit is used in table top equipment which is plugged into a standard power socket, then it is likely that compliance to the commercial and light industrial emissions standard is required. In this case to meet the conducted emissions requirement, a suitable mains filter should be installed. We recommend Schaffner types FN321 and FN612.

3.4.1 Routing of wires

To minimise the pick-up of electrical noise, the low voltage DC connections and the sensor input wiring should be routed away from high-current power cables. Where it is impractical to do this, use shielded cables with the shield grounded at both ends. In general keep cable lengths to a minimum.

4. Chapter 4 Technical Specification

All figures quoted at an ambient temperature from 0 to 50°C unless otherwise stated.

4.1 Control Options

No. of Loops	1
Control Loops	On/Off, single PID
Control Outputs	Analogue, Time proportioned or Motorised Valve control with or without feedback.
Cooling Algorithms	Linear, Water, Fan, Oil
Auto/Manual Control	Bumpless transfer or forced manual output.
Setpoint rate Limit	Off to 9999.9 engineering units per minute
Motorised Valve Control	Valve Position bounded or unbounded. Individual Valve Positions for heat and cool
Tuning	One-shot Auto tune or Manual.
Loop Alarms	High absolute, Low absolute, Deviation high, Deviation low, Deviation band, All with separate hysteresis.
Application Specific	Humidity control

4.2 Display

3504	Primary Large 5 digit display, Information centre 16 character header and 3 lines of 20 characters
3508	Primary Large 41/2 digit display, Information centre 8 character header and 3 lines of 10 characters
Technology	LCD with yellow/green backlight Red alarm beacon

4.3 Standard Digital I/O

Allocation	2 Off. Not isolated from each other. Not isolated from the PV inputs Logic Bi-directional input/outputs Logic or Contact closure input
Digital inputs	Voltage level: input Inactive 0 to 7.3Vdc, Active 10.8V to 24Vdc Contact closure: input active <480ohms, inactive >1200ohms
Digital outputs	18Vdc at 9 to 15mA drive capability.
Changeover relay	Contact rating Min Load 1mA at 1V Max Load 2A at 264Vac resistive 1,000,000 operations with addition of external snubber

4.4 All Analogue and PV Inputs

Sample rate	9Hz (110msec.)
Input filtering	OFF to 999.9 seconds of filter time constant (f.t.c.). Default setting is 1.6 seconds
User calibration	Both the user calibration and a transducer scaling can be applied.
Sensor break	a.c. sensor break on each input (i.e. fast responding and no dc errors with high impedance sources).
Ranges	mV, mA, volts -2V to +10V, -1V to +2V or RTD (pt100), pyrometer inputs
Thermocouple types	Most linearisations including K, J, T, R, B, S, N, L, PII, C, D, E with linearisation error < ±0.2°C CJC: Automatic (internal), external, 0°C, 45°C, 50°C reference blocks
General	Resolution (noise free) is quoted as a typical figure with f.t.c. set to the default value = 1.6 second. Resolution generally improves by a factor of two with every quadrupling of f.t.c. Calibration is quoted as offset error + percentage error of absolute reading at ambient temperature of 25°C Drift is quoted as extra offset and absolute reading errors per degree of ambient change from 25°C.

4.5 PV Input

Accuracy	±0.1% ±1lsd	
Sample rate	9Hz	
Input filter	Off, 0.2s to 60s filter time constant. Default setting 1.6s.	
40mV Range	Range	-40mV to +40mV
	Resolution	1.9µV (unfiltered)
	Measurement noise	1.0µV peak to peak with 1.6s input filter.
	Linearity error	0.003% (best fit straight line)
	Calibration error	±4.6µV ±0.053% of measurement, at 25C ambient.
	Temperature coefficient	±0.2µV/C ±28ppm/C of measurement, from 25C ambient.
	Input leakage current	±14nA
	Input resistance	100MΩ
80mV Range	Range	-80mV to +80mV
	Resolution	3.2µV
	Measurement noise	3.3µV peak to peak with 1.6s input filter.
	Linearity error	0.003% (best fit straight line)
	Calibration error	±7.5µV ±0.052% of measurement, at 25C ambient.
	Temperature coefficient	±0.2µV/C ±28ppm/C of measurement, from 25C ambient.
	Input leakage current	±14nA
	Input resistance	100MΩ
2V Range	Range	-1.4V to +2.0V
	Resolution	82µV
	Measurement noise	90µV peak to peak with 1.6s input filter.
	Linearity error	0.015% (best fit straight line)
	Calibration error	±420µV ±0.044% of measurement, at 25C ambient.
	Temperature coefficient	±125µV/C ±28ppm/C of measurement, from 25C ambient.
	Input leakage current	±14nA

	Input resistance	100MΩ
10V Range	Range	-3.0V to +10V
	Resolution	500µV
	Measurement noise	550µV peak to peak with 1.6s input filter.
	Linearity error	0.007% for zero source resistance (best fit straight line) Add 0.003% for each 10Ω of source + lead resistance.
	Calibration error	±1.5mV ±0.063% of measurement, at 25C ambient.
	Temperature coefficient	±66µV/C ±60ppm/C of measurement, from 25C ambient.
	Input resistance	62.5kΩ to 667kΩ depending on input voltage.
PT100	Range	0 to 400Ω (-200C to +850C)
	Resolution	50mC
	Measurement noise	50mC peak to peak with 1.6s input filter.
	Linearity error	0.033% (best fit straight line)
	Calibration error	±310mC ±0.023% of measurement in C, at 25C ambient.
	Temperature coefficient	±10mC/C ±25ppm/C of measurement in C, from 25C ambient.
	Lead Resistance	0Ω to 22Ω, matched lead resistances.
	Bulb current	200µA
Thermocouple	Uses 40mV and 80mV ranges.	
	Types	J, K, L, R, B, N, T, S, PL2 and C.
	Linearisation error	±0.2C
	Internal Cold Junction	
	Calibration error	±1.0C at 25C ambient.
	Ambient rejection ratio	40:1 from 25C ambient.
	External Cold Junction	0C, 45C and 50C.

4.6 Analogue Input Module

mV input	100mV range - used for thermocouple, linear mV source, or 0-20mA with 2.49Ω external burden resistor. Calibration: ± 10μV + 0.2% of reading Resolution: 6μV Drift: < ± 0.2μV + 0.004% of reading per °C Input impedance: >10MΩ, Leakage: <10nA
0 - 2Vdc input	-0.2V to +2.0V range - used for zirconia. Calibration: ± 2mV + 0.2% of reading Resolution: 30μV Drift: < ± 0.1mV + 0.004% of reading per °C Input impedance: >10MΩ, Leakage: <20nA
0 - 10Vdc input	-3V to +10.0V range - used for voltage input. Calibration: ± 2mV + 0.2% of reading Resolution: 200μV Drift: < ± 0.1mV + 0.02% of reading per °C Input impedance: >69KΩ
Pt100 input	0 to 400ohms (-200°C to +850°C), 3 matched wires - up to 22Ω in each lead without errors. Calibration: ±(0.4°C + 0.15% of reading in °C) Resolution: 0.08°C Drift: < ±(0.015°C + 0.005% of reading in °C) per °C Bulb current: 0.3mA.
Thermocouple	Internal compensation: CJC rejection ratio >25:1 typical. CJ Temperature calibration error at 25°C: <± 2°C 0°C, 45°C and 50°C external compensation available.

4.7 Digital Input Modules

Module type	Triple contact input, Triple logic input
Contact closure	Active <100ohms, inactive >28kohms
Logic inputs	Current sinking : active 10.8Vdc to 30Vdc at 2.5mA inactive -3 to 5Vdc at <-0.4mA

4.8 Digital Output Modules

Module types	Single relay, dual relay, single triac, dual triac, triple logic module (isolated)
Relay rating	2A, 264Vac resistive (100mA, 12V minimum)
Single Logic drive	12Vdc at 24mA
Triple logic drive	12V at 9mA per output
Triac rating	0.75A, 264Vac resistive

4.9 Analogue Output Modules

Module types	1 channel DC control, 1 channel DC retransmission (5 max.)
Range	0-20mA, 0-10Vdc
Resolution	1 part in 10,000 (2,000-noise free) 0.5% accurate for retransmission 1 part in 10,000 2.5% accurate for control

4.10 Transmitter PSU

Transmitter	24Vdc at 20mA

4.11 Transducer PSU

Bridge voltage	Software selectable 5 or 10Vdc
Bridge resistance	300Ω to 15KΩ
Internal shunt resistor	30.1KΩ at 0.25%, used for calibration of 350Ω bridge at 80%

4.12 Potentiometer Input

Pot resistance	330Ω to 15KΩ, excitation of 0.5 volts

4.13 Digital communications

Allocation	2 modules fitted in slots H & J (isolated)
Modbus	RS232, 2 wire or 4 wire RS485, max baud 19.2KB in H module & 9.6KB in J module
Profibus DP	High Speed, RS485, 1.5Mbaud (**Slot H only**)

4.14 Master communications

Allocation	Slot J
Modbus	RS485 4-wire or RS232
Parameters	25 read/write

4.15 Alarms

No of Alarms	8 Analogue, 8 digital. Can be wired to any internal parameter
Alarm types	Full scale, deviation, sensor break plus application specific
Modes	Latching or non-latching, blocking, time delay

4.16 User messages

No of messages	Maximum 100, triggered by operator or alarm or used for custom parameter names
Format	Up to 16 characters

4.17 Control functions

No of loops	One
Modes	On/off, PID, motorised valve with or without feedback
Cooling algorithms	Linear, water, oil or fan
PID sets	3 per loop
Manual mode	Bumpless transfer or forced manual output, manual tracking available
Setpoint rate limit	Display units per second, minute or hour

4.18 Setpoint programmer

Programmer modes	Synchronous
Programmer types	Time to Target or Ramp Rate
No of programs	A maximum of 50 programs. Programs can be given user defined 16 character names
No of segments	200 segments total or 50 maximum per program
Event outputs	Up to 8, can be assigned individually to segments or called as part of an event group

4.19 I/O Expander

10 I/O version	4 changeover relays, 6 normally open relay contacts, 10 logic inputs
20 I/O version	4 changeover relays, 16 normally open relay contacts, 20 logic inputs

4.20 Advanced functions

Timers	4, On Pulse, Off delay, one shot and min-On
Totalisers	2, trigger level & reset input
Counters	2, up or down counters
Real time clock	Day of week and time
Application blocks	24 digital operations
	24 analogue operations
	2 eight input logic operators, 2 eight input analogue operators
	16 user values
	BCD input
	Customised input linearisations
	Mathematical Add, Subtract, Multiply, Divide, Constant, Absolute difference, Maximum, Minimum, Sample and Hold, Input 1 to the power of input 2, Square root, Log(10), Ln, 10 to the power of input 1, i.e. to the power of input 1
	Logical AND, OR, XOR, Latch, Equal, Not Equal, Greater than, Less than, Greater than or equal to, Less than or equal to.
	Humidity Wet and dry bulb technique
Software Tools	iTools Configuration Tool
	OPC Scope Trending and Data logging
	iClone Lite Lightweight configuration cloning
	Graphical Wiring Editor Drag and drop wiring tool, self-documenting
	View Builder Custom Animation Screens
	iTools Wizard Question and Answer configuration screens

4.21 General specification

Supply	110 to 240Vac -15%, +10%. 48 to 62Hz. 20 watts max 85-264Vac
Inrush Current	High Voltage controller – 30A duration 100µs Low Voltage controller – 15A duration 100µs
Operating ambient	0°C - 50°C (32°F to 131°F) and 5 to 95% RH non condensing
Storage temp	-10°C to +70°C (14°F to 158°F)
Panel sealing	IP65, plug in from front panel
Dimensions and weight	
3504	96H x 96W x 150D (mm) 0.6Kg
3508	96H x 48W x 150D (mm) 0.4kG
Electromagnetic compatibility	EN61326-1 Suitable for domestic, commercial and light industrial as well as heavy industrial environments. (Domestic/light industrial (Class B) emissions, Industrial (Class A) Environment immunity emissions).
Safety standards	EN61010, installation category 2 (voltage transients must not exceed 2.5kV)
Atmospheres	Not suitable for use above 2000m or in explosive or corrosive atmospheres

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